ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK

BRANCH OFFICES AT 1750 MONADNOCK, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

VOL. XXXVIII. No. 7. FRIDAY, FEBRUARY 17, 1905.

CONTENTS

EDITORIAL:
- Townsend-Esch Bill Passes the House.... 133
- Henderson's Cost of Locomotive Operation 133
- Use of A.-C. System for Traction..... 133
- Automatic Couplers in Europe..... 134
- Railroad Transition Upward 134
- Tramway Competition and Electric Traction in England 135
- Mallet Compound at work on the B. & O. 135
- Trade Catalogues 136

ILLUSTRATED:
- An Alternating-Current Trolley Line.... 136
- Boiler Explosion on the N. Y. Central.. 140
- Automatic Couplers in Europe..... 146
- Hayes Lifting Derail..... 150
- Four-Cylinder Balanced Compounds for the New Haven 151
- A Motor Driven Bench Drill..... 152
- Roof Plan for a Coal Pocket..... 152

CONTRIBUTIONS:
- Train Resistance 136

MISCELLANEOUS:
- The Cost of Locomotive Operation 139
- Timber Preservation Experiments in Texas 144
- American Railway Appliance Exhibition.. 150
- "Composite" Telegraph Lines..... 151

GENERAL NEWS SECTION:
- Notes 49
- Meetings and Announcements..... 51
- Personal 51
- Elections and Appointments 53
- Locomotive Building 54
- Car Building 54
- Bridge Building 55
- Railroad Construction 55
- Railroad Corporation News 56

On February 9, the House of Representatives passed the Townsend-Esch bill by a majority so large as to be practically unanimous. The provisions of this bill were printed in the *Railroad Gazette* February 3d and have received much notice in the public press, the cardinal points being that the bill increases the Interstate Commerce Commission from five members to seven, creates a court of transportation, and provides that after the Commission has declared what shall be a reasonable rate in place of a rate found unjust the new rate shall become operative in 30 days, after which, 30 days more is allowed for an appeal to the court of transportation, which will review these cases sitting as a court of equity. There has been no instance in recent years which more clearly shows the deterioration of the House from the deliberative body it was created to be to a purely political organization. It is not apparent that anybody wants the Townsend-Esch bill to become a law, nor that anybody expects that it will. Chairman Hepburn complains that his own bill, which contained the more liberal provision that protested rate decisions should remain *in statu quo*, with the shipper protected by a bond given by the railroad, was written chiefly by Attorney General Moody—that is to say, by the Administration—and therefore that it should not have been so lightly set aside. Therefore it may be considered that President Roosevelt, who, next to E. P. Bacon, was the originator of the present movement, is dissatisfied with the Townsend-Esch bill; yet the House passed it by a vote of 326 to 17. What evidently happened was that the representatives from all parts of the country, north, east, south and west, saw a chance to please their constituents by throwing a stone at the railroads. Uncle Joe Cannon said there must be legislation, and there was legislation. It did not much matter what the bill was, and in view of the fact that it was pretty sure not to pass the Senate it seemed wise to make it as radical as possible. It is only to be regretted that the House had not the courage of its convictions, and failed to adopt the charmingly frank and lucid provision of the Davey bill that rate regulation was never to be understood as implying that rates could be raised by order of the Commission. So the matter has gone over to the Senate, and meantime a new complication arises. The Senate, grievously annoyed at the President's attitude in the San Domingo matter, has taken unto itself far greater treaty making powers than it has hitherto exercised; powers so great that it is the current saying in Washington that they make the Secretary of State a kind of expert clerk of the Senate. Consequently the President's pet measure, as modified by the wisdom of the House to include provisions which the President never intended, is to go before a hostile body; a body very willing to check what it considers undue rapidity of action on the part of the Chief Executive. To say that the house has killed the Federal rate regulation bill with kindness is to overstate the case, but it may be confidently assumed that things will now move slower than they have been moving during the past few weeks.

In another column in this issue of the *Railroad Gazette* is the first of a series of articles by Mr. G. R. Henderson on the "Cost of Locomotive Operation." These articles are to appear later in book form. Mr. Henderson needs no introduction, as his work in the mechanical department of railroads and his many contributions to technical literature are well known to all interested in any phase of locomotive operation. In all of his writings he combines a clear understanding of first principles with mature judgment and experience. It might be said that he establishes the general laws of variation by means of theoretical considerations, and then modifies the general laws by means of constants derived from experience. In this way the correct relative value of any factor in a general problem is at once made apparent. In studying the cost of locomotive operation each factor will be taken up separately in detail, and finally the relation of each to the whole problem. Mr. Henderson's point of view in his study of locomotive operation is similar to that of the late Mr. Wellington, in that he is concerned directly and solely with results, and does not permit himself to be led aside into theoretical discussions of an academic nature. An example of this will be found in the table comparing the thermal efficiency of different kinds of coal, in the present instalment, where the respective steaming qualities are expressed in terms of the ton-miles obtainable per unit of each coal. Therefore it will be understood that although these papers are written by a man of expert mechanical training, their value is not limited to the mechanical department, but they put the problems of that department, together with the results desirable to achieve, in the shape where the operating department can most readily get at them.

The opening of traffic on the first section of the Indianapolis & Cincinnati Traction Company's line marks the first regular service with single-phase alternating-current motors. Short lines operated by single-phase motors have been in operation in the country for some time, notably between Schenectady, N. Y., and Ballston Spa, but the Indiana line is the first one that has been built for through service between large cities in competition with existing steam roads. Several years ago a single-phase road was projected between Washington, Annapolis and Baltimore, but owing to financial difficulties the road was not completed.

For a good many years both of the large American electrical companies have been striving to perfect a single-phase motor suitable for long-distance high-speed service. Both companies have apparently solved the problem, and a new field has been opened up for electric traction. Of course there are many who believe that the ultimate solution of the electric railway problem rests with the development of a three-phase motor, and its advocates have many good arguments in its favor. But whether single-phase or three-phase motors are used, the fact remains that the direct-current system will soon be relegated to a rather limited field.

As noted in another column, it is esti-

mated that there will be an annual saving in wages alone of $6,570 in the three transformer stations between Indianapolis and Rushville under what it would have cost for the rotary converter stations if direct current had been used. This is equivalent to an annual saving of about $22,000 on the ten stations between Indianapolis and Cincinnati, a distance of 125 miles. In this single-phase system, the alternating current leaves the power house at 33,000 volts, and is stepped down to 3,300 volts by the transformers in the substations. All switches, etc., for each substation are in the central power stations, and hence only occasional inspection of the substations is necessary. On the other hand, if the direct-current system had been used each substation would have been equipped with transformers and rotary converters constantly in charge of a skilled attendant. Without entering into a theoretical discussion of the relative economy of direct and alternating current systems, it can be safely assumed that other economies in favor of the alternating-current system will develop in service, owing to the reduction in power losses between the central station and the motors on the cars.

That the general application of automatic couplers to European rolling stock will come about as slowly if not slower than it did in this country is strikingly emphasized in the report to the International Railway Congress by Mr. Noltein, of the Moscow-Kazan Railway, which is printed in part elsewhere in this issue. Mr. Noltein shows some of the many and diverse mechanical difficulties to be overcome, the enormous expense involved in making the change and the cost of the delays to traffic in handling composite trains during the transition period. It took nearly twenty years of patient and concerted effort on the part of the Master Car Builders' Association before the present type of vertical plane automatic coupler was adopted and demanded by Federal statute for all cars engaged in interstate traffic. The actual change from the old link and pin type of coupling was not made in a year or at small cost; it took more than fifteen years and cost the railroads many millions of dollars before the last link and pin disappeared. In some ways, however, the change made in this country was a comparatively simple problem compared to the task which confronts the railroads of Europe. In the first place, the old bull-nose drawbar was a self-contained, combined buffing and draw-gear and the attachments to the car did not need to be changed in any way when applying the automatic coupler. But on European rolling stock, the coupling devices, whether screw couplings or simple chain links and hook, transmit only the pulling stresses, generally through some form of continuous draw-gear and the spring buffers on each side of the central coupling take up and transmit the buffing shocks through the underframe. Most of the mechanical difficulties involved in adapting an automatic coupler of the Master Car Builders' type to such cars arise from this construction, since any temporary device to be used during the transition period must retain the buffers as an integral feature and permit them to be removed when all cars are equipped with automatic couplers. Again, the underframes of most of the European cars are not strong enough to admit of the application of a central buffer and draw-gear and to rebuild and strengthen all of the cars now in use would involve an outlay of more time and money than the cars are really worth. A gradual change by applying automatic couplers only to new equipment seems to be the one way in which any improvement can be made.

While dwelling at some length on the difficulties of adopting the automatic coupler, Mr. Noltein also points out the urgent necessity of such a course if the railroads of Europe hope to continue to operate their lines at a profit. Increased train load is one obvious method of improving the economy of certain classes of freight transportation and another is the radical innovation of electrification if it can be successfully applied, but any considerable increase in train load is impossible at present because of the limitations imposed by the strength of the prevailing form of couplings and draft gear. Even the strongest and best designed automatic couplers and draft gear fail under the extremely severe conditions of American freight service. With the crude couplings in use abroad in which there is excessive slack, a train load of more than 1,000 tons is almost out of the question. There is also to be considered the delay in yards in switching trains which would be saved with automatic couplers and the large waste of lineal track space because of the wide separation of cars fitted with chain couplings and buffers. Entirely aside from a humanitarian motive, which was the prime factor in the movement in favor of automatic couplers in this country, the European railroads can certainly afford to spend at least as much as the American railroads have spent in adopting some form of automatic coupler for they would benefit by such a change enormously and immediately. The Master Car Builders' type is no longer an experiment, but a pre-eminent success, meeting every requirement, so that the cost and uncertainty of experimentation does not confront the European lines. Every delay now will only add to the trouble and expense which will be incurred when the change comes about eventually, if it ever does.

RAILROAD TRANSITION UPWARD.

The historian of American railroad affairs when, from a future view-point not far distant, he looks back on the events of the last seven years, from the first month of 1898 to the first month of 1905, will almost certainly pronounce it the most eventful and picturesque in our railroad annals. Other periods, like that of the six years' ushered in by the panic of 1873, or the eight years of fevered, almost frenzied railroad construction that followed the Civil War have had their dramatic features, sometimes for good, more often for ill; but their elements have been simple and what we may call their stage effect monotonous, albeit the colors were lurid. The septenary just past, on the contrary, has been highly composite; it has been differentiated into fresh and novel forms of railroad phenomena; it has had of paradoxes not a few; and whether studied by the economist, the statist, the investor or the railroad physicist, it has been most profoundly interesting.

The most prominent feature running through the period and not ended yet is the fact that the American railroad is in rapid transition upward. We do not refer so much to increased railroad construction, which has not been very marked; nor even to mechanical invention and improvement or advances in administration, which have been much more noteworthy. We refer rather to the railroad values in the market as perhaps the best general test. That it is not a final and conclusive test may be conceded. The market value may often times be merely the high mark of an inflation that precedes collapse—the pride, so to speak, that goes before the fall—but not often is this the case if the advance proceeds steadily or holds its ground through a considerable series of years. We take here but a single telling fact which can be easily enough reinforced by others. Sixteen stocks of great American railroads, practically all of them of the "trunk line" type, in the first month of 1898 averaged about $62 in the quoted price per share on the New York Stock Exchange; the same stocks averaged in the first month of the present year $121 a share, or an increase of approximately 100 per cent. The increases range from about 800 per cent. down to about 16 per cent. If minor roads were to be added to the group the average of the increment of market value would probably be somewhat larger. The sweeping statement stands that Wall Street's appraisal of the value of American steam railroad properties—whether that appraisal is the wild guess of the speculator or the cool judgment of the wary investor—has more than doubled.

The prime factor in this amazing rise in railroad values—industrial prosperity and the expanded product of the field, the factory, the forest and the mine—is, of course, obvious. But we are apt by long gazing upon it to let it obscure the obstacles which the upward railroad transition has had to overcome. "High finance" has been one, for, while it may immediately and for speculative ends raise the quoted value, its later results are almost sure to be negative with the solid investor; and it infects rather than affects the railroad market. Add the stupendous capitalization of the industrials and their page volumes of securities poured out as absorbents of funds; the electric lines as rivals of the railroad not merely in traffic but in investment; higher wages and complicated labor broils; the psychological tendency of great bodies of staid investors to distrust the "boom" on principle; and finally and recently the federal action and attitude on the rate question. All these obstructive elements make the upward bound in values of the American railroad still more remarkable and especially so just at the present time. To use a figure of speech, if a skilled economist, blindfolded to the actual quotations, could have put the negative weights named in one scale and "prosperity" in the other, we question whether he would have hazarded his reputation by forecasting any general rise of railroad values at all—certainly nothing to compare with the rise which has actually come.

The same economist would have run his craft, well loaded with the maxims of the market, on other paradoxical reefs. Theory, precedent and the prophecies of level-headed financiers fixed the climax of the great

"boom" of 1901-2 in railroad securities as the date of a panic of large and disastrous magnitude. The climax came but not the panic, and, instead, a steady and not unwholesome reaction in 1903. The great wave of speculation swept up the shore but receded without breaking and now the refluent tide has moved upward anew. More solid than hypothesis is the idea that it was the railroads with their good earnings—spite of higher cost of operation—which "saved the market" when it might have gone to wreck on the shoals of "industrial" finance. Again we have heard the prophecies of woe based on the great issues of railroad bonds many of them with foreclosure power. Yet the railroads have carried them easily and it was but recently that a single great railroad corporation was able in a single day to market a bonded loan of $75,000,000. The prophets had forgotten the bond-carrying power of increased traffic, as well as the more general fact—notwithstanding the new device of "holding" companies—that historically an epoch of bonding has also been an epoch of railroad profit and progress.

Because we are at or near the end of a septenary of railroad transition upward it by no means follows that, after the scriptural analogy, we are to have a septenary of blight. All the deeper signs, indeed, point the other way and toward a prolongation of the main features of the period just past. The lesson of the upward transit is that, while many errors of financing have struck in, the railroads of the country have struck their roots of prosperity much deeper; that closer administration following harmony and concentration of interests have solidified rather than weakened the average railroad as an investment; and that, when the inevitable time of crisis comes, the railroad will not be, as in times past, foremost in the list of sufferers. One of the most significant tokens of a situation appears in the present tense when, right in the face of sharp federal attack, the railroad securities theoretically most affected persistently climb upward.

Tramway Competition and Electric Traction in England.

English railroad companies are again complaining about the serious effect of municipal tax-aided tramway competition upon their London suburban traffic. Not all the companies have issued their reports at the time of writing, but those that have done so show considerable falling off. There are other contributory causes besides tramway competition, it is true, such as the depressed state of trade in a number of localities (especially the building trades); and the exceptional fogs of December; but the tramway competition has more or less severely affected both steam railroads and the deep-level tube systems. The South Eastern experienced a falling off of 2,100,000 passengers during the six months, as compared with the same period of 1903, representing nearly $100,000. This decrease Mr. Bonsor, the chairman, explains as chiefly arising in the metropolitan area, where the London County Council electric conduit tramways cause most severe competition. The railroad, he considers, can never hope to compete with tax-aided competition, and its only course is to be take off a certain number of trains which had been put on for the accommodation of the working classes and which those classes are now leaving in order to patronize the trams, and by partially closing some of the stations which are principally affected. The South Eastern is closely concerned with the section of railroad that is to be equipped by the London, Brighton & South Coast Railway on the single phase alternating current system, and is looking to this experiment (Battersea Park to Peckham Rye, five miles) to give it "reliable statistics, which are wanting at the present time, as to the cost of working an old line by electricity."

The Great Eastern chairman, Lord Claud Hamilton, has also blamed the electric tramway competition for the drop of 1,631,220 in suburban passengers. He, of course, does not complain of tramways owned by public companies, but of municipal systems supported out of the taxes. "The position was that if the tramways were run at a loss the company, as a ratepayer had to contribute, whereas a profit could only be made by abstracting traffic from them." Lord Claud thinks that some arrangement ought to be come to whereby a remission of rates could be made to companies which are the chief taxpayers in districts in which they contribute to competition against themselves. The Great Eastern is doing its best to develop long distance traffic, but much of its district lacks population.

The Metropolitan Railway, which started its first electric section on January 1st, is working a portion of its trains between Baker street station and Uxbridge through Harrow, electrically, and the number of electric trains into and out of Baker street is being gradually increased. It is hoped that steam will soon be entirely dispensed with on that section. The operations on the Inner Circle are being pushed forward energetically, and this company's section will have a few trains running in March. In the new trains provision has been made for two classes only, and this, says Sir Charles McLaren, the chairman, means ultimately abolishing second class entirely on the circle and also between Baker street and Uxbridge. Sir Charles believes that when the Metropolitan gets its new mode of working thoroughly established the prospects will be good, but "the result attending the electrical working is, to some extent, a speculation." The expenses during the transition period must be heavier, as the necessity of working by steam and electricity at the same time is unavoidably attended with greater expense than the working by one system alone.

The London, Tilbury & Southend Railway recently raised new capital for widening its line between Bow and Barking and adapting that section for electrical traction.

The East London Railway chairman, the Hon. A. E. Gathorne-Hardy, is eager to have his line electrically equipped, and believing that in the near future the suburban systems of all the London railways will be worked electrically, he thinks it a pity "that the Underground Lines could not be prevailed upon to face the initial outlay, which would not be very large, rather than temporarily interrupt the physical connection with other lines." Mr. Gathorne-Hardy considers that the East London, like many other lines, will profit by the experimental experience of the London-Brighton Company with single phase traction.

The City & South London tube line experienced a fall in traffic this half-year, and a small dividend drop too. Here again the chief cause is the London County Council's tramway competition, which draws off the tube traffic in fine weather, but fails to do so to the same extent in wet and foggy times. The company has now got out plans, has arranged the necessary capital, and is about to invite tenders, for the extension of its tube from Islington to Euston. The cost will be $2,000,000, but the connection with other important railroad termini which it will give is expected to greatly increase the traffic over the City & South London.

The Great Northern & City tube opened to Finsbury Park last year, which did so badly at first, improved its receipts in the last half of 1904, but not sufficiently to enable it to pay the debenture interest out of revenue.

The Waterloo and City tube under the Thames has had a better time this half year and has once more succeeded in reducing its working expenses, *i.e.*, to 44.64 per cent. of the receipts, against 46.44 per cent. in the corresponding period of 1903.

The Liverpool Overhead Railway for the first time in its experience, showed a decreased traffic, in its report to December, 1904. Slack trade is partly the cause.

The North Eastern Railway Company on January 27 received a deputation, heated by the Duke of Northumberland, regarding passengers' grievances on the electrical sections between Newcastle-on-Tyne and the coast. Among the complaints were: The absence of conductors, the inadequacy of the accommodation, the withdrawal of first class carriages, the opening of carriage doors inwards to the danger of passengers, and the insertion in first class contract tickets that such tickets were available only if and when first class carriages were attached to the trains. In reply, the chairman, Sir Edward Grey, said that the overcrowding was being remedied. A new door was being designed which would open outwards and obviate the necessity for conductors; the first class carriages would be restored by partitioning off a portion of each vehicle, but first class smoking compartments they could not promise. The "if and when" clause applies only to the electrical portions. The changes will take some months to introduce.

The Mallet compound of the Baltimore & Ohio has been in service about a month, and from what can be learned of its performance so far it is more than justifying the high expectations of its designers and builders. It has demonstrated its ability to haul a considerably larger tonnage than it was designed for, takes curves satisfactorily and rides easily. One fireman has no difficulty in keeping up steam with an inferior grade of coal. The locomotive is being used on a 16 mile 1 per cent. grade between Rockwood and Sand Patch, Pa., and one day during this time its record was as follows: The temperature was about 20 deg., with a heavy wind and snow storm prevailing, the track being very heavy on account of a 10-in. snowfall in the mountains. The locomotive left Rockwood pushing a train of 40 cars, engine and caboose, the train weighing 1,850 tons and the engine 160. For the first nine miles the Mallet was worked in compound gear at reduced capacity. About seven miles from the summit of the grade a fast freight train headed the same direction was encountered, having stalled on the grade. This train consisted of 15 cars and a caboose, weighing about 650 tons, with a 120 ton engine. The rear train was coupled into the other and the two helped on up the grade to Sand Patch at the summit. Both of the forward locomotives were failing for steam, due to the snow storm and length of time on the road. The Mallet was simpled twice in pushing around 7 deg. reverse curves. The steam pressure the entire time ranged between 225 lbs. and blowing off. The coal was a poor grade of soft run-of-mine, mixed with snow, 60 per cent. being slack, and the lumps being full of bone, causing much clinkering. At one point the forward locomotives shut off steam upon encountering a green block signal. The en-

gineman of the compound continued working steam and pushed both trains and locomotives for a considerable distance, around a 7-deg. reverse curve on the 1 per cent. grade, stalling in simple gear when the leading engineman applied the air. Snow on the tops of the cars and about the running gear added somewhat to the tonnage given.

TRADE CATALOGUES.

Reinforced Concrete Arches.—Daniel B. Luten, President of the National Bridge Company, Indianapolis, Ind., has issued a small pamphlet containing a brief synopsis of the calculations necessary for designing a Luten reinforced concrete arch of any span. The peculiar feature of this design is the introduction of tensile reinforcement in the pavement under the arch which acts as a tie to hold the haunches in their relative position. A very flat arch can be obtained in this way without unduly increasing the loading on the haunches or the thickness at the crown. The pamphlet contains a number of illustrations of concrete arches of this type both for railroads and highways, together with data as to cost and time of completion. The National Bridge Company will furnish plans and consulting supervision for these bridges on a 10 per cent. royalty basis.

Graphite Paint.—An artistic little pamphlet issued by the Detroit Graphite Manufacturing Co., Detroit, Mich., shows half-tone views of a number of prominent structures painted with "Superior Graphite," including the steel work in the Government printing office at Washington; the Flatiron Building, New York; bridges at Niagara Falls and Toledo, and a naval coaling station. A list of other notable structures so painted is given, and specifications for proper painting with this paint.

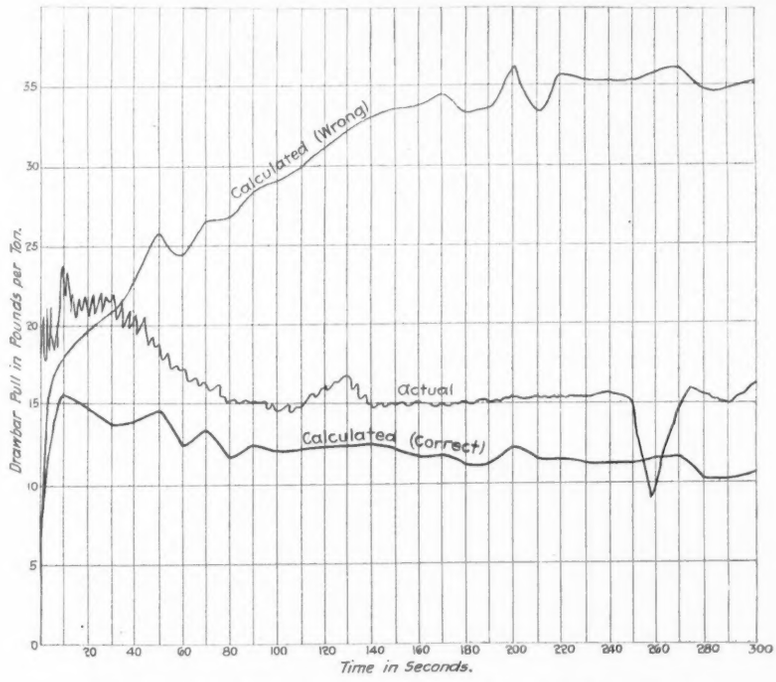
Bolts, Screws, Nuts and General Supplies.—Hammacher, Schlemmer & Co., New York, send their illustrated catalogue No. 262, which is devoted exclusively to bolts, screws, nuts and general supplies. Illustrations and tables giving the standard sizes and prices of the above goods are given. Among the supplies illustrations of turnbuckles, pulleys, leather belting, oil tanks, tool steel, chain, tackle blocks, hand trucks, scales, shovels, steel and wooden wheel barrows, etc., are shown.

The Union Switch & Signal Co., Pittsburg, Pa., has issued Section 11 of its catalogue of interlocking and signaling devices, which was begun in 1902. The present issue contains 64 pages and is devoted to electric locks, electric slots, hand releases and time locks. These devices are very fully illustrated; and the hand releases, both mechanical and electric, are described at some length.

Machinery and Tools.—The Brown & Sharpe Mfg. Co., Providence, R. I., sends the 1905 edition of its general catalogue. There are 494 pages devoted to descriptions and illustrations of machines and machinist tools. A number of pages are also devoted to general information and tables, which makes it valuable to the workman as a book of reference.

Structural Steel Work, Bridges, Etc.—Milliken Brothers, New York, send a handsome catalogue 7 in. x 11 in., bound in leather. There are upwards of 450 pages containing views of buildings, bridges, etc., in which the steel work was designed, furnished and erected by the above company. Useful information and tables, arranged for the use of engineers, architects and builders, are given as well as standard sections of steel angles, I-beams, channels, etc. The dimensions of the above are shown in both millimeters and inches, and all weights are given in kilograms per meter and in pounds per lineal foot. This catalogue is also published in Spanish, German and French.

Inspirators.—The Hancock Inspirator Company, New York, send a miniature catalogue of its various types of inspirators. Illustrations showing both exterior and interior views of the company's works are given. A short history of the Hancock inspirator is also given as well as cross section drawings and detailed descriptions of the different types of inspirators made by the company.



Actual and Calculated Values of Drawbar Pull of Freight Trains.

CONTRIBUTIONS

Train Resistance.

Beckley, W. Va., Jan. 18, 1905.

To the Editor of The Railroad Gazette:

I noticed recently in your issue of November 4 an article by Mr. Chester A. Crandell, M. E., on train resistance. His calculations as to passenger trains seem to be about correct for the formulæ used; but in the case of freight trains, they are entirely wrong. To begin with, he assumes a 91 car freight train weighing 1,015 tons, or about 11 tons per car. This would evidently mean empty cars, where the drawbar pull per ton of weight would be much greater than for loaded cars. According to paper No. 942 by Mr. A. C. Dennis, in volume L, Transactions of the American Society of Civil Engineers, the resistance is given as about twice as much for empty box cars as for loaded cars, being about 4½ lbs. per ton for the latter. Recent experiments by a prominent railroad have indicated as low a resistance as 2¼ lbs. per ton for loaded coal cars of 100,000 lbs. capacity, for a speed of 10 to 15 miles per hour. This, however, is a matter of record and experiment, and of course varies for different kinds of cars loaded or empty.

The most conspicuous error in Mr. Crandell's article is that he has in some way miscalculated the second column of his table 4, which should give values ranging from 4 to 6.7 lbs. instead of corresponding values from 4 to 31.3 lbs. Consequently the sixth column giving the totals is also wrong. For instance at the end of 300 seconds the velocity is, by table 3, 15.88 miles per hour, and in the last column of table 4 he gives 35.26 lbs. per ton where he should have 10.66 lbs., using his own formulæ. On his Fig. 6 I have had plotted by heavy line the correct values of the drawbar pull of freight trains calculated by his formulæ, and they are generally less than one-half of the calculated values shown by Mr. Crandell. The results shown by the dynamometer record as given by Mr. Crandell are interesting and I should like to see a similar record for a heavily loaded coal train.

C. P. Howard.

[The author of the article to which our correspondent refers has already called our attention to errors in his tables. The diagram plotted by Mr. Howard is correct.—Editor.]

An Alternating Current Trolley Line.

In view of the fact that there was a track mileage of 24,561 miles of electric railway in the United States in 1903, according to Poor's statistics for that year, it is rather remarkable that there has not hitherto been a single through line operated by alternating current. The first regular service with a single phase car was inaugurated in Rushville, Ind., Dec. 30, 1904, on the lines of the Indianapolis & Cincinnati Traction Company.

This company was organized in February, 1903, to build an electric line from Indianapolis by way of Rushville and Connersville, Ind., and Hamilton, Ohio, to Cincinnati, a total distance of about 125 miles. Having in mind the idea of an interurban line of the type common in the western states, the Indianapolis & Cincinnati Traction Company

Bridge over Blue River, near Morristown, Ind.—75-ft. Spans.

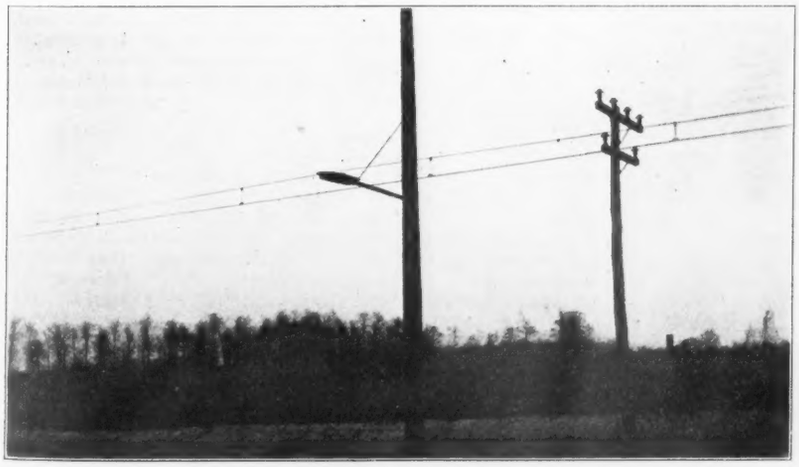
was organized to build a double-track through line between the points named which would be able to compete with the steam roads on account of frequency of service, convenience of location and low fares. The line is built on private right of way even in the smaller towns through which it passes, and the rails are only laid on streets or highways in cities and towns of such size that private right of way could not well be secured. Under the provision of the franchise of the Indianapolis Traction Terminal Company, interurban lines are allowed to enter the city over the tracks of the city company by such routes as the city designates, upon payment to the city company of an agreed or ascertained compensation. The Indianapolis Traction & Terminal Company has made a uniform agreement with interurban roads for entrance into the city over its tracks, whereby interurban roads pay four cents for each passenger carried on the interurban cars while on the city lines, and this entitles them to all of the privileges of the terminal station where all the interurban roads center.

The Indianapolis & Cincinnati Traction Company has franchises in the cities of Rushville and Connersville which permit of running limited cars, making only one stop in each city. In all smaller towns the franchises also provide for the carrying of freight, express and mail matter under reasonable regulations, so that the company expects to develop this branch of the business.

Leaving the Traction Terminal Building at Market and Illinois streets in Indianapolis, the cars of the company will pass out over Ohio and Delaware streets, Virginia avenue and Prospect street to the city suburbs, and then east until they reach the Cincinnati, Hamilton & Dayton road. In going out of Indianapolis there are no grade crossings of railroads, all crossings being above or below grade. From there, as far as the city of Rushville, the road runs parallel to and north of the C., H. & D.; from Rushville the line runs alongside and to the south of the C., H. & D. to a point beyond Glenwood; from there on it follows almost an air line to Connersville, avoiding the bend of the steam road, and shortening the distance about one and one-half miles. From Connersville the exact route has not yet been determined, but it will be almost an air line to the town of Oxford, thereby shortening the distance; from there on it again parallels the C., H. & D. as nearly as possible to Hamilton. The company will build its own line from Hamilton to Cincinnati, unless a satisfactory agreement can be made with the traction companies already running between those cities. The line has already been built between Indianapolis and Rushville, 41 miles, and a through service between those towns will soon be established. At an early date the road will be extended to Connersville. Between Indianapolis and a point eight miles east of Rushville—a distance of nearly 50 miles—there is no grade exceeding 1½ per cent. From that point on towards Cincinnati the country is less level and in some cases straight lines have been preferred, even at the expense of some increase in grade; but with the alinement and grade considered together, it is claimed that greater speed can be obtained with comfort and safety to passengers than on any steam road now running between Indianapolis and Cincinnati. So far as the profile of the road has been as yet determined, the heaviest grade will be 4 per cent., and it is believed that no greater grade will be necessary on the entire line. The roadbed is graded 28 ft. wide on top for a double track, with slopes on fills and in cuts of 1½ to 1, and upon a grade line that puts the track in most instances above the level of adjacent lands, so as to avoid trouble on account of snow. The bridges on the line are designed for a load of a continuous train of 100-ton cars. All the abutments are built for double track, but the superstructures at this time are laid for one track only, and the same is true of the private right of way; the grade is prepared for double track, but the only place where this has been laid as yet is on city streets and such highways outside the cities as are used. The track is laid with 70-lb. rail in 60-ft. lengths, connected with Weber rail joints, and the switches and other special work furnished by the Buda Foundry & Manufacturing Company, of Chicago, are built to steam railroad standards.

The trolley wire is suspended along the private right of way from poles set in the center of the grade 100 ft. apart, with a

Westinghouse 75-h.-p., A. C., Single Phase, Series Wound Motor.



Section of Overhead Construction.

bracket made of angle iron looped at the end, so as to carry a large flat porcelain insulator, from the top of which is run a $^{7}/_{16}$ in. steel strand cable or "messenger" wire. The No. 000 grooved copper trolley wire is carried 8 in. under the messenger cable, to which it is attached every 10 ft. with specially made steel clamps, a construction known as the catenary suspension. The steel messenger wire is drawn tight. With this construction danger from trolley breaks is reduced to a minimum. The insulators are large and strong and are not likely to break, but, if they should, the steel cable would remain suspended from the top of the bracket. As the trolley is attached to the steel cable every 10 ft., breaks will be very infrequent, and, if one should occur, not more than 10 ft. of the trolley would be loose. The catenary construction provides a practically level trolley with no sudden bends at the insulators as is found with the ordinary suspension, a point which is of great advantage to fast running cars. The trolley wire is suspended 13 ft. above the top of the rail.

Where the tracks are in the streets, the poles are set on the sides of the streets and the trolley is suspended from span wires. Otherwise the construction is the same as along the private right of way. The system of electrical distribution requires transformer stations about 10 or 12 miles apart, and the alternating current is transmitted from the power house to these transformer stations at 33,000 volts, single phase, 25 cycles per second, and is reduced and fed into the trolley at a potential of 3,300 volts. The high tension current is carried from the central power station to the transformer stations on No. 4 bare copper wires, two wires to each transformer station. They make a complete circuit and permit the placing of the circuit-breakers and switches at the central power house, so as to do away with the necessity of attendants at the transformer stations. The high tension lines are carried on a separate line of poles set near the edge of the right of way, provided with carefully and strongly constructed cross arms and equipped with large porcelain insulators on iron pins.

The entire system is provided with two metallic circuit (four copper wires) telephone lines, one of which is used exclusively by the train despatcher. The other line is used for general company business. Each car is provided with a telephone, by means of which the conductor can talk with the train despatcher at fixed points. Jack boxes are placed on the poles at intervals of 2,000 ft., from any of which the conductor of a car or any one else with a telephone can call up to report an accident or for any other purpose. The four telephone wires are carried by porcelain insulators on cross-arms near the top of the trolley poles, and are thus far removed from the high tension lines. The wires are transposed every 500 ft. in order to avoid disturbances from the current in the transmission lines.

Within the limits of Indianapolis, a distance of approximately three miles, the cars will be run over already existing lines, and will be operated by direct current at 550 volts. Within the limits of the city of Rushville, they will be operated by alternating current at the same potential; on intervening sections the trolley will be fed by alternating current at 3,300 volts, 25 cycles per second, single phase. Thus the first single phase railway exemplifies the possibility of operating the same equipment from both direct and alternating current lines and illustrates the voltage flexibility of the system, one of its most advantageous features. The power station from which it is intended to operate the entire road is at Rushville. From this plant 33,000 volt transmission circuits are run to the points of transformation and there reduced to 3,300 volts before connection to the trolley.

As has been said, the road is divided into sections of 10 and 12 miles, each of which is supplied with current from a transformer station. Three such stations have been erected between Indianapolis and Rushville, by Puise & Porter, contractors of Greensburg, Indiana. The transformer houses are very small, measuring but 21 x 23 ft., but are carefully and substantially built. The foundations are of concrete; the walls are of brick laid in cement mortar; and the floors for both the first and second stories are of concrete upon steel beams. The roof is built upon concrete base. The doors and windows are provided with steel shutters, and the whole structure is made thoroughly fireproof and can be closed and left alone with safety.

In each of the transformer stations there are at present installed two 300 k.w. oil-insulated step-down transformers, 33,000 to 3,300 volts. Space has been provided for an additional transformer of the same capacity. On the second floor of each transformer station there are installed the lightning arresters and disconnecting switches. There are no automatic switches of any type in these stations, as they are controlled only through the switchboard in the power station. There is nothing at the station which requires constant attention and only occasional inspection will be necessary. This does away entirely with the expense usually incident to the sub-station of other systems, which usually amounts to the wages of three men at each sub-station, aggregating not less than $6 per day. The annual saving in wages on the three transformer stations between Indianapolis and Rushville made possible by the alternating current system amounts therefore to $6,570, or a total annual saving on the 10 transformer stations between Indianapolis and Cincinnati in wages alone of $21,900. In addition to this, there will be a large amount saved in the maintenance and repair of machinery. The power house serves as an additional transformer station, and contains two 300 k.w. lowering transformers, wound for 3,300 volts primary and 550 volts secondary circuits, which are used to feed that portion of trolley included within the limits of the city of Rushville.

The power house at Rushville has three 300 h.p. Babcock & Wilcox boilers, with natural gas fuel, although provision has been made to burn coal, if at any time the supply of gas becomes insufficient. The two generator units consist of a 500 k.w. Westinghouse revolving field alternator, 25 cycles per second, direct connected to a 700 h.p. Corliss type, cross-compound condensing engine, built by the Fulton Iron Works, of St. Louis. Both engines and generators are designed for 50 per cent. overload capacity. Two pairs of 250 k.w. air blast transformers are arranged to change the current which comes from the generator at 2,300 volts three-phase to 33,000 volts two-phase for transmission to the transformer stations along the line.

The cars are 55 ft. long over all, divided into three compartments. The first compartment, 9 ft. 10 in. long, is for baggage. The cars are intended for single-end operation, and space for the motorman is provided in front of the baggage compartment. The middle compartment is a smoker with a seating capacity of 36 people, and the third compartment, occupying the remainder of the car, has a seating capacity for 38 people. Each truck is equipped with two 75 h.p. single phase alternating current Westinghouse motors, and the cars are equipped with the Westinghouse multiple unit control system, so that they can be operated either singly or in trains. The motors are controlled by the rheostatic system and may be operated on either alternating or direct current. Both straight and automatic air-brakes are provided on each car, the straight being used when the cars are run singly and the automatic when they are run in trains. The motors on the present car equipment are geared for a maximum speed of 45 miles an hour for local service. Each car is equipped with two trolleys, one of the Union standard type with a trolley wheel, to be used when working from the direct current lines in Indianapolis, or from the low voltage alternating current lines in Rushville. The other trolley is of the bow high speed type, designed for service at 3,300 volts alternating current. It is believed that with the high voltage alternating current trolley wire and the sliding contact bow trolley, heavy freight can be hauled advantageously without experiencing the difficulties hitherto encountered when service of this kind has been attempted on the direct current system.

Local cars are operated each way every hour, making stops upon signals at all of the cities and towns and at the principal crossings of the country. These cars are all provided with compartments in which baggage and light express matter may be carried. They are designed to run at a schedule speed of 30 miles per hour. To properly take care of the through service, additional "limited" cars will be put on the line; each of these will be equipped with four 150 h.p. motors designed to operate at a schedule speed of 50 or 60 miles per hour, as under the provisions of the various franchises they will not have to make any stops in the country or at any of the smaller towns and will only be required to make one stop at each of the larger intervening cities. It is expected that when the road is completed from Indianapolis to Cincinnati these "limited" cars will be able to make the trip from the center of one city to the center of the other in three hours' time. It is the intention at a later date to run two express cars per day in each direction, taking care of the light freight and express business.

The road has been built in every detail with a view to the handling of heavy freight, even to the extent of carrying it in long trains. Whenever, in the intervening cities, short radius curves could not be otherwise avoided, the private property of the inside corner has been purchased and the sidewalks and curbs set back so as to make easy curves and permit the handling of heavy trains.

Charles L. Henry is President of the company and the line was designed and built under the direction of Sargent & Lundy, consulting engineers, with electrical equipment furnished by the Westinghouse Electric & Manufacturing Company. The Chief Engineer of the Indianapolis & Cincinnati Traction Company is Mr. John W. Moore.

The Congo Free State is building a railroad from Stanleyville, near the middle of the continent, where the navigation of the Congo is interrupted by a cataract, up the river 72 miles to Pontkierville, beginning a little north of the equator and ending a little south of it, with more than a thousand miles of navigable river between it and the old Congo Railroad. An Italian engineer employed on this new line writes to the Italian railroad journal, *Il Monitore delle Strade Ferrate*, that the country on the line, although on the equator, is a veritable paradise; the climate is like spring, and there are no mosquitoes and no malaria. (It is about 1,600 ft. above sea level.) The work of construction is not particularly difficult, except the clearing of the forest, which requires dynamite. The natives are peaceable,

willing to work, and sober. This gentleman, Signor de Jacobis, recommends the country strongly to his countrymen, saying they will find it much like Southern Italy. Some 30 miles of grading for the railroad have been completed, trains run on 15 miles, and the whole is to be completed some time in 1906. It will connect with a considerable stretch of navigable river coming from the southeast, towards Lake Tanganyika, which is the boundary between the Congo Free State and German East Africa.

The Cost of Locomotive Operation.

BY G. R. HENDERSON.

PREFACE.

In the study of the cost of locomotive operation presented herewith it is hoped that a clear understanding of these expenses may be had, together with the effect of various physical influences upon them. It is, of course, out of the question to determine or present absolute figures of cost that could be used without qualification, as the price of material and labor varies enormously throughout the country, as well as being subject to continual fluctuations. Thus in California and Arizona labor is from 30 to 50 per cent. more costly than in Illinois and Iowa, and here again, it is higher than in the New England States. Ordinary materials follow a similar rule, for the principal claim to increased compensation for labor is the higher cost of material products. For any locality, more or less variation also exists, if not during the same period, at least in different years, determined principally upon the general prosperity of the country at large, and the law of supply and demand.

But if we cannot present absolute values of costs, we can determine the effects of different circumstances upon the cost of producing transportation, and study the methods of reducing this to the lowest limit; we can also in most cases find out the variation of costs in the form of a ratio, so that knowing the unit or base cost for a certain locality or condition, the cost under other circumstances may be closely estimated. Our investigations may therefore properly cover the following fields:

(1) The cost and value of various materials, with the expense for handling and caring for the same.

(2) The returns obtained by various methods of using the different supplies.

(3) The effect of grade, speed, loading, etc., upon the consumption of both material and labor.

(4) The combined effects upon all the various items which go to make up locomotive operating expenses.

The different items of expense are here taken up in regular order, and the effective value of the materials and methods of using them discussed, as well as the influence of physical and operating conditions upon the returns from such supplies. After these are examined individually the general effects upon the total cost are also studied, and the most economical method of operating under different physical conditions examined.

INTRODUCTION.

The cost of operating locomotives represents about one-third of the total working expenses of railroads—that is, the expenses exclusive of interest, dividends and taxes. These operating expenses as a rule vary from 50 to 70 per cent. of the revenue, so that the proportion of the income expended for running and maintaining the engines may be expected to fall between 17 and 23 per cent., or, in round numbers, 20 per cent.

In a paper presented to the American Engineering and Maintenance of Way Association in 1904, Mr. Berry, Chief Engineer of the Union Pacific Railroad, gave the operating expenses of that company for four years as follows:

Items.	Per cent. of whole	
Maintenance of way and structures:		
Ballast	0.28	
Frogs and switches	.35	
Protection of river banks	.03	
Repairs of roadbed and track	8.33	
Repair of snow fences and sheds	.10	
Spikes and rail fastenings	.86	
Superintendence	.55	
Renewals of rails	2.28	
Renewals of ties	3.01	
Repairs and renewals:		
Bridges and culverts	1.81	
Road crossings, etc.	.32	
Buildings and fixtures	1.99	
Telegraph	.15	
Stationery and printing	.01	
		20.07
Maintenance of equipment:		
Superintendence	0.63	
Repairs and renewals:		
Locomotives	*10.19	
Passenger equipment, cars	2.07	
Freight cars	5.32	
Work cars	.51	
Shop machinery and tools	1.03	
Stationery, etc.	.80	
		20.55
Conducting transportation:		
Superintendence	1.50	
Engine and roundhouse men	*10.10	
Fuel for locomotives	*10.80	
Water, oil, waste, etc., locomotives	*1.36	
Train service	5.55	
Train supplies and expenses	1.91	
Switch, flag, and watchmen, etc.	2.36	
Telegraph expenses	2.44	
Station service and supplies	5.62	
Car mileage	.61	
Hire of equipment	.04	
Loss and damage—property and personal	1.88	
Advertising, rents, etc.	4.66	
Stationery and printing	.53	
		49.36
Taxes paid		5.64
General expenses		4.38
Grand total		100.00
Average cost per train mile for the 4 years considered		$1.17

Here it will be seen, the items that make up the actual charges of locomotive operation amount to 32.45 per cent., including taxes (these items being marked with a star *), or about 34 per cent. when taxes are not included. While these figures are taken from a single line, they represent quite fairly the general trend of operating expenses for the principal railroads of this country, and they also indicate the important part which locomotive operation plays in the expenses as well as the receipts of railroads. On large systems, the total is a vast amount, running into many millions yearly, yet in spite of this fact, there is little *definite* information regarding the various individual items of expense, when by "definite" we mean the actual expenditure per unit of work accomplished. It is true that we can divide the total figures of any one account by the engine mileage, train mileage, ton mileage, or any other factor, and obtain a unit cost for the system or division, but this will not differentiate the up-hill and level work, or the slow and time freights, nor can we gather any idea of the cost per horse-power developed per hour, nor the effects of grade, speed, loading, etc.

We can further make comparisons between the monthly performances of locomotives, in order to determine whether the coal consumption per engine or ton-mile is increasing or diminishing, but if it be increasing, it is often difficult to assign a reason for the same, although a perfectly logical one may exist. It is on account of these very difficulties that this work is undertaken, with the hope of clearing up, in part at least, the uncertainties arising from variable physical and traffic conditions, and enabling railroad officials to prognosticate and explain some of the seemingly unaccountable increases and decreases in the cost of operation. In order to accomplish this it will be necessary to study each of the different items separately, and to examine their relative and actual values for the purposes to which they are applied, as well as the effect of physical and operating conditions of various kinds and magnitude. For this purpose the expenses will be classified under the general heads of: (A) supplies; (B) maintenance; (C) service; and these will be subdivided into the individual items enumerated below:

(A) Supplies.—(1) Fuel; (2) water; (3) lubricants; (4) waste; (5) tools; (6) miscellaneous.

(B) Maintenance.—(7) General repairs; (8) running repairs; (9) renewals.

(C) Service.—(10) Engineers; (11) firemen; (12) hostling and turning; (13) cleaning fires; (14) wiping; (15) inspecting; (16) firing-up.

These different items must be examined in regard to all phases of quality and quantity which affect the cost of operation, and also as affected by grade, speed, loading, weather, etc. After investigating the individual varieties of the different items, we must study their combined influence upon the subject of our discussion, and determine the most economical method under given fixed traffic or physical conditions.

SECTION A.—SUPPLIES.

Fuel.

As in the case of the railroad previously quoted, this is generally the greatest item of expense which has to be met, and it is also one of the most difficult to control. At the very outset we find ourselves confronted by the fact that much that is bought and sold as fuel, is not fuel at all. We will therefore first consider the question of quality of fuel.

Quality.—The various kinds of fuel in use upon locomotives are practically without number, and each one has a different steam-making value. From undried, rain-soaked wood to mineral oil, representing the poorest and the best of fuels used in this country, there are an unlimited number of grades sold at a practically unlimited number of prices. The steam-making value of a fuel is determined by its chemical composition, and by the number of "heat units" which it will give out when uniting with the oxygen of the air in the process termed "burning," and the latter is dependent upon the former. The fuels used depend almost entirely upon the quantity of carbon and of hydrogen which they contain, along with oxygen, for their heating value, although the latter element (oxygen) is merely a supporter of combustion, and it is usually considered negative in its action. For instance, the formula of Dulong, which is ordinarily used to determine the number of British thermal units (B.t.u.) from the analysis is expressed as follows:

$$\text{B.t.u.} = 14{,}500\ \text{C} + 62{,}100\ \left(\text{H} - \frac{\text{O}}{8}\right) \ldots (1)$$

where C, H and O represent the quantities of carbon, hydrogen and oxygen in a given amount of fuel, ordinarily, one pound. For every B.t.u. so calculated we should theoretically be able to raise one pound of pure water one degree Fahrenheit in temperature, though the efficiency of the boiler, being less than unity, prevents our realizing ordinarily more than two-thirds of this heat. Now when we compare the analysis of ordinary wood and Texas oil, we see at once the great variation in heating value due to the proportions of carbon, hydrogen and oxygen.

Constituent.	Percentage in Ordinary wood.	Texas oil.
Carbon	37.50	84.60
Hydrogen	4.50	10.90
Oxygen	30.75	2.90

In the oil the carbon and hydrogen are over twice as great, and the oxygen 10 times less than in wood, so that we are quite prepared to find the heat units in a pound of wood to be in the neighborhood of 5,800, and in oil 18,800—over three times as great.

Most fuels—and especially coals—contain large quantities of non-combustible matter, commonly termed *ash*, the amount varying from 1 or 2 per cent. up to 30 per cent., the

western coals, as a rule, containing greater proportions than the eastern coals. This material is so much waste, as it generates no heat, but must itself be heated up to the temperature of the fire-box before it falls into the ash-pan. Occasionally small samples of a ton or two will contain still larger percentages of slate, *rock* and materials that might make fair ballast for the track, but are very discouraging to the enginemen, especially when the train is behind time and trying to recover its schedule. Such material is also usually paid for at the contract price for coal. These cases are extraordinary, but the author has known them to occur more than once, generally accompanied by complaints from the transportation department of the failure of the engine to do the work expected of it.

In order to give some tangible idea of the relative values of various kinds of coal, and also of the uselessness of making comparisons between services performed when the fuel is not identical, the following table is introduced. Of course, it must not be understood that the coals mentioned will always show as indicated when tested, but the values given in B.t.u. are selected from different authorities. The last column gives the number of ton-miles in freight service that would ordinarily be made over such a road as the Chicago & North Western to the pound of coal burned, and is based on results actually obtained with Illinois coal, averaging, perhaps, about 10,000 B.t.u. per pound.

THERMAL VALUE OF COALS.

Kind.	State.	Locality.	B. t. u. per lb.	Ton-miles, per lb.
Anthracite	Pennsylvania		14,000	7.00
Anthracite, pea	"		12,300	6.15
Semi-bituminous	"	Connellsville	13,300	6.65
Semi-bituminous	West Virginia	New River	14,000	7.00
Bituminous	Pennsylvania	Pittsburg	13,000	6.50
"	"	Youghiogheny	13,000	6.50
"	Ohio	Hocking Valley	13,400	6.70
Block	Indiana	Brazil	14,000	7.00
Bituminous	Illinois	Streator	11,400	5.70
"	"	Mt. Olive	11,700	5.85
"	"	Macoupin County	9,800	4.90
"	"	Perry County	9,800	4.90
"	"	St. Clair County	10,000	5.00
"	"	Mercer County	13,000	6.50
"	Iowa	Good Cheer	8,700	4.35
Cannel	Kentucky		14,000	7.00
Bituminous	Arkansas	Huntington County	11,800	5.90
Lignite	Arkansas		9,200	4.60
"	Colorado		13,500	6.75
" slack	Colorado		8,500	4.25
"	Texas		12,900	6.45
Bituminous	Kansas	Burlingame	10,500	5.25
"	"	Cherokee	13,400	6.70
"	"	Frontenac	12,100	6.05
"	"	Leavenworth	11,100	5.55
"	"	Leavenworth, nut	6,600	3.30
"	"	Osage City	10,700	5.35
"	Missouri		12,200	6.10
Lignite	Iowa		8,700	4.35
"	Wyoming		10,400	5.20
"	Utah		11,000	5.50

From the above we see that some coals will generate twice as much heat as other coals and consequently will do twice as much work. On some large roads, many different kinds of coal are used. At times this is confined to certain specific divisions, and at other seasons it is indiscriminately mixed, so that one month the fuel may be much poorer than another. This will immediately cause an increased coal consumption per 100 ton miles, and if this point is not carefully watched, it may be difficult to answer some of the unpleasant questions which are sure to follow. Some roads have made a practice of inspecting large proportions of the coal purchased, and recording information regarding the quality, etc., so that the matter can be promptly taken up for adjustment if the quality depreciates. However, even if the coal has a good appearance, but comes from another locality, it cannot be stated definitely without tests or analyses whether it is as good a steam generator as that from some other mine. The purchasing agent can generally help out in the matter by ordering from those mines which produce the greatest heat units in a pound of fuel, but then coal mining is a particularly uncertain proceeding, liable to be interrupted at any time by strikes or physical disturbances, when the buyer must look elsewhere, and generally the urgency is so great that little opportunity is afforded to make a careful selection, and he is glad to get whatever can be shipped promptly—sometimes even to take back coal that has been once rejected on account of absence of lump or presence of slate. Under such circumstances there is only one thing to be done—make the best of it. Recourse has been had to coke forks to sort out the lumps for passenger engines, leaving the slack for freight and switch engines, in order to keep the passenger trains on time. It is needless to again state that such a condition will very materially affect the amount burned per ton mile.

(To be continued.)

Boiler Explosion on the New York Central.

BY GEO. L. FOWLER.

One of the most remarkable boiler explosions, in its effects, of any on record, occurred on the Mohawk Division of the New York Central at 1.15 a.m., February 4th. By the concussion of the explosion of a boiler on a westbound passenger train near Whitesboro, four miles west of Utica, an eastbound express train of eight cars was derailed and wrecked.

There is no direct evidence as to exactly what took place, but from the appearance of the wrecked train and the location of the boiler and wrecked engine, it seems probable that the accident occurred just after the eastbound engine had passed the one that exploded. The windows were blown out across the track, and it is probable that the truck of the forward car was derailed and that the balance of the train followed, though it is possible also that the concussion had an influence on the derailment of the whole train. The general appearance of the cars is shown in the accompanying

FIG. 1.

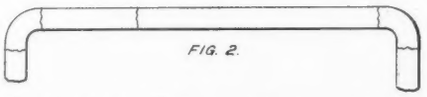


FIG. 2.

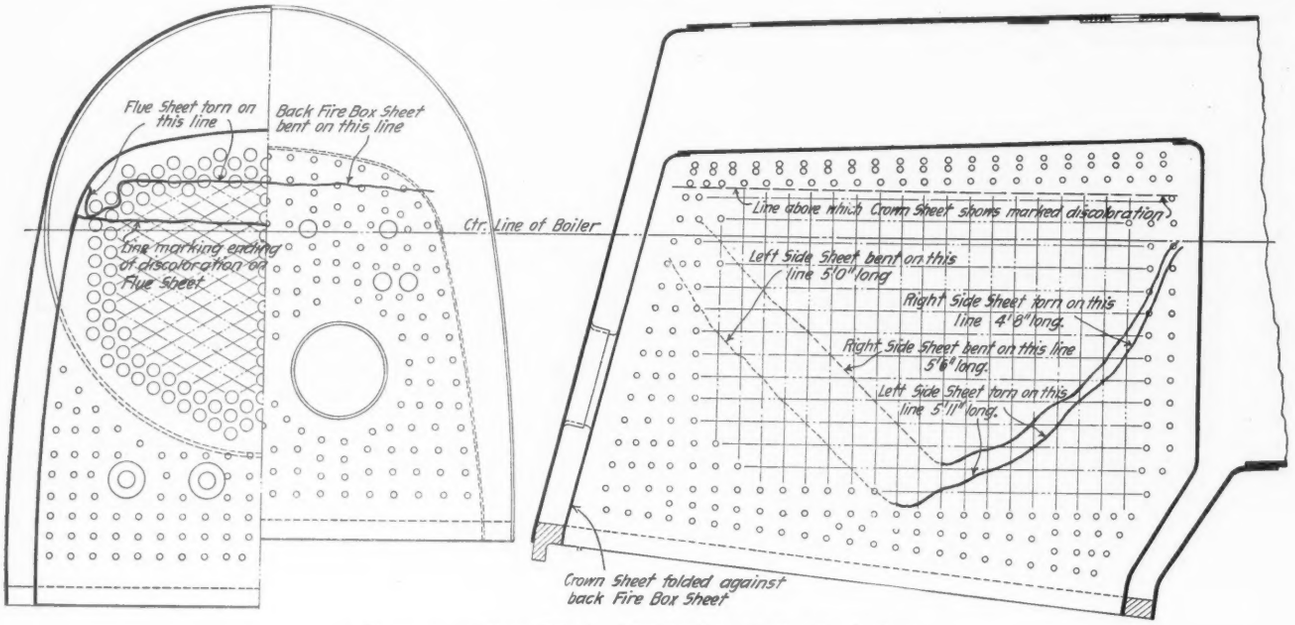
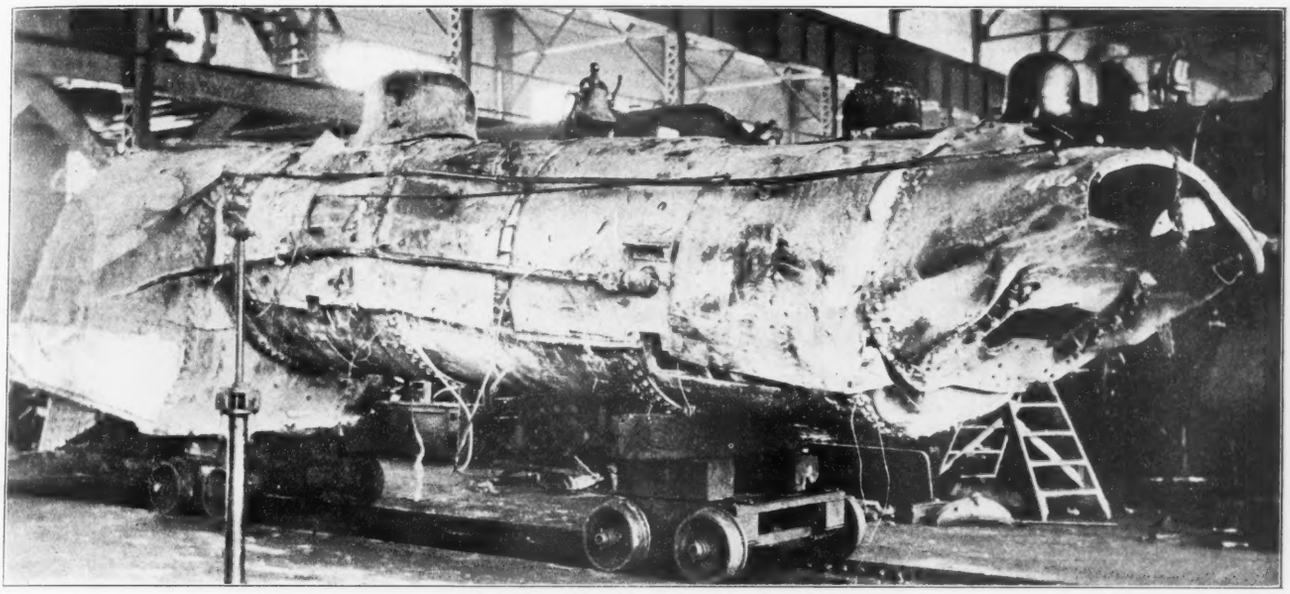
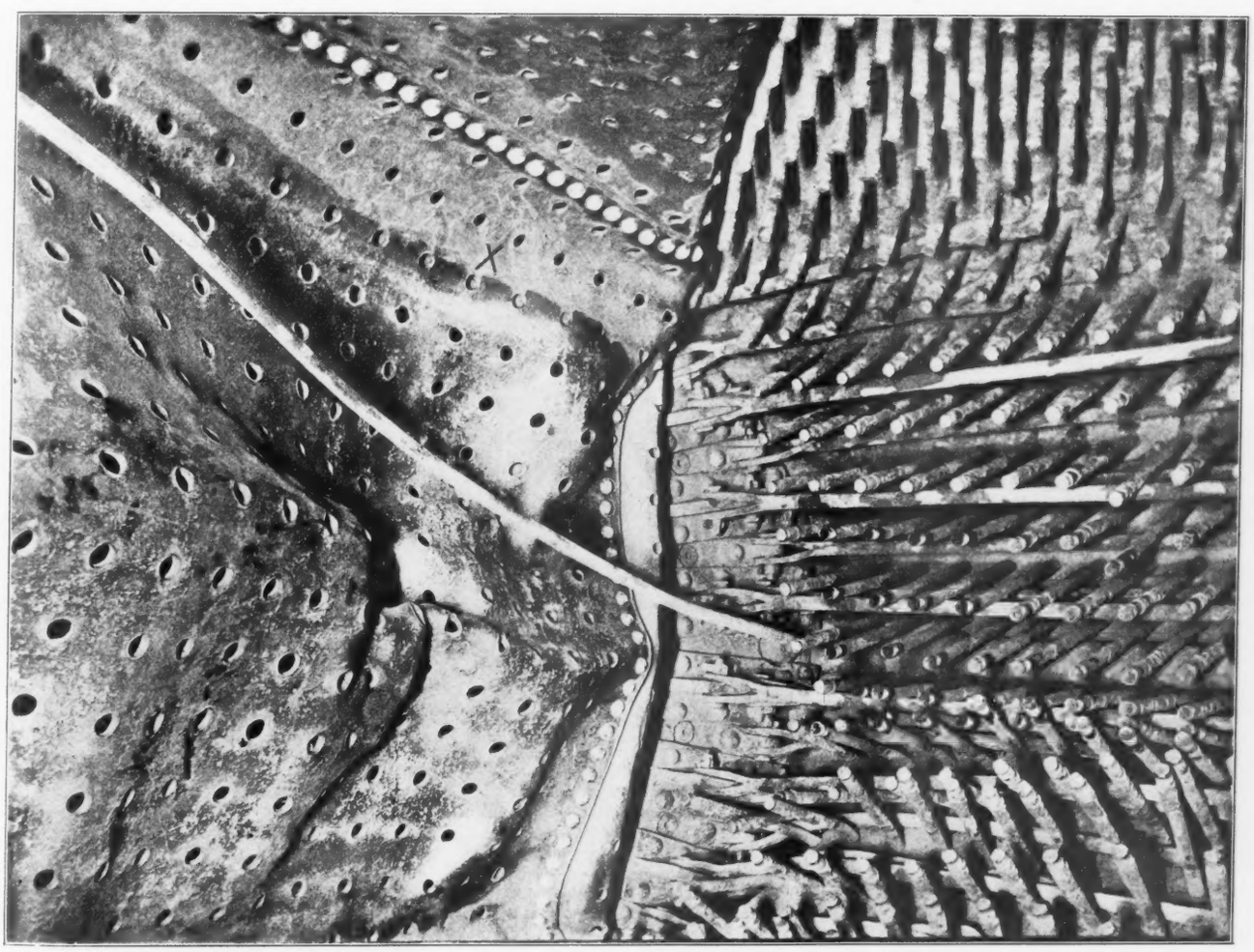

Flue Sheet torn on this line
Back Fire Box Sheet bent on this line
Ctr. Line of Boiler
Line marking ending of discoloration on Flue Sheet
Line above which Crown Sheet shows marked discoloration
Left Side Sheet bent on this line 5'0" long
Right Side Sheet torn on this line 4'8" long.
Right Side Sheet bent on this line 5'6" long.
Left Side Sheet torn on this line 5'11" long.
Crown Sheet folded against back Fire Box Sheet

Diagram to Show Effect of Whitesboro Boiler Explosion.



Side Perspective of Boiler.



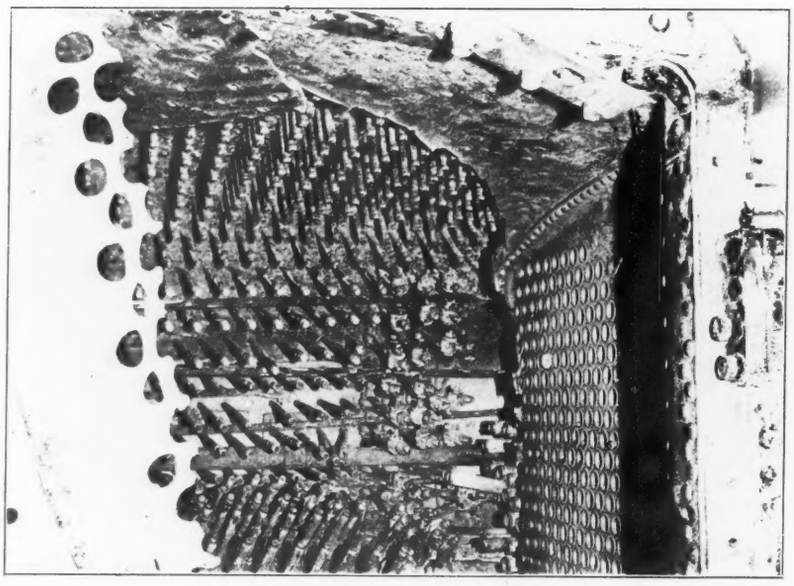
Interior of Firebox. Boiler Tipped Over on Left Side.

illustration, the engine of the train not being derailed.

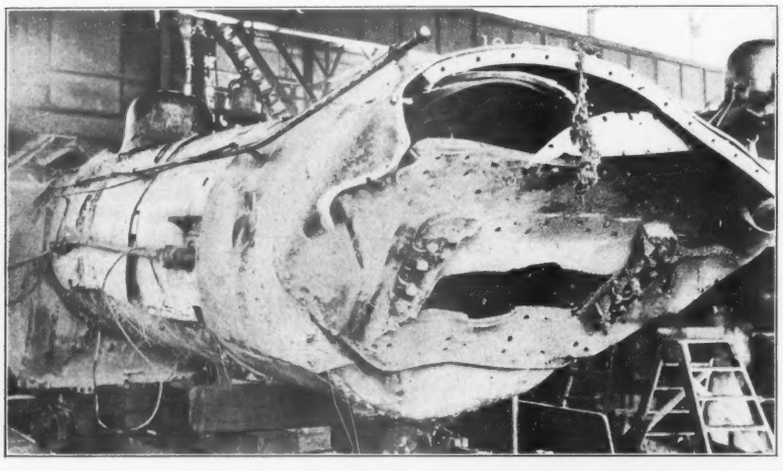
None of the cars of the train whose boiler blew up were injured, but the exploded boiler sailed almost straight ahead through the air and landed across the eastbound track, fully 630 ft. ahead of where the remainder of its locomotive stopped on the westbound track, and considerably behind the rear car of the eastbound train, which the boiler's explosion had blown from the rails. Both the engineer and fireman of the blown-up locomotive were killed. No passengers of their train were injured, but 27 passengers on the eastbound derailed train were hurt, more or less painfully, but not fatally.

The boiler that exploded was on engine No. 2795, which was of the class K (4-4-2) Atlantic type. It was built at the Schenectady Works of the American Locomotive Co. in 1903, and had recently been turned out of the repair shops in first class condition. There seems to be some doubt whether or not the engineer took water at Utica, though there is a record that he stopped there two minutes for that purpose.

Through the courtesy of Mr. J. F. Deems, the General Superintendent of Motive Power, a set of illustrations is presented showing several views of the wrecked boiler. An examination of the sheets shows conclusively that the failure was due to the overheating of the crown-sheet.



Front Interior of Firebox. Boiler Tipped Over on Left Side.



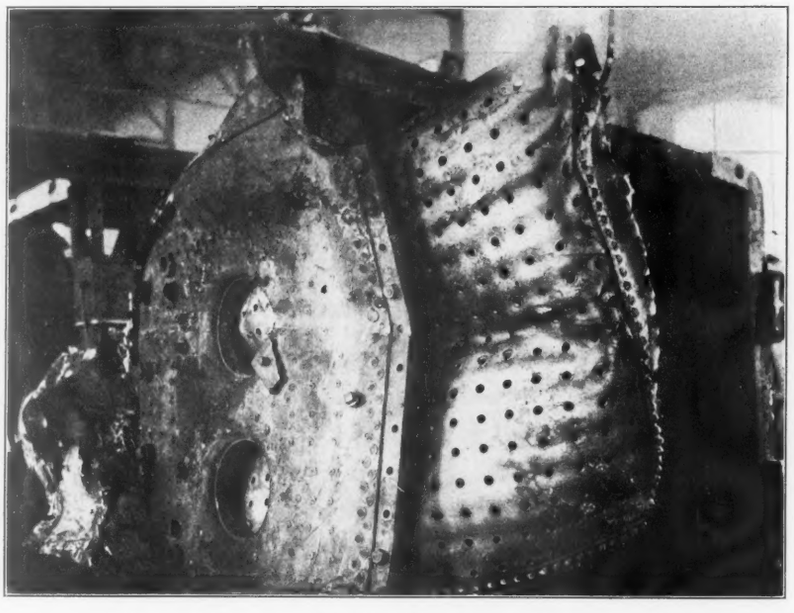
Head End Perspective of Boiler.

The first thing to attract attention in an examination of the fire-box of the boiler was the area of heated surface that was clearly indicated by the beautiful blue color, with a very distinct line of demarcation between that and the unheated portions, a point that is clearly brought out at X in the illustration of the interior of the fire-box. This heated area covered nearly the whole surface of the crown-sheet and extended down at the front end to the third row of tubes in the back tube sheet. By the third row of tubes is meant the third horizontal row, counting in a diagonal line, from the top.

The boundaries of the overheated zone are at the rivetted seam between the crown-sheet and the back fire-box sheet. Laterally the blued section extended to the third row of staybolts on each side, counting from the side towards the center. This bluing was varigated in color, some parts approaching a yellowish sheen which indicated a still higher temperature. The crown-sheet showed evidences of a preliminary yielding prior to the actual explosion, in that it was tufted down at each staybolt as shown in Fig. 1. This bending partook of the nature of a combined longitudinal and lateral corrugation, the former being the deeper and about ¼ in. from the crown to the bottom.

The evidences of overheating are so apparent as to be beyond any manner of doubt. That the overheating was very intense at the forward end of the crown-sheet is evidenced by the appearance of the ends of the sling stays that still remain in place attached to the outside sheet. The front three rows are burned away until many of them are ragged at the ends, while the 10 central rows, extending back to correspond with the whole heated surface of the crown-sheet are blued at the ends, though uninjured except as the rivetted heads at the end have been stripped off when the stays pulled through the sheet. The crown-sheet was radially stayed with screwed stays except at the front, where sliding stays were used, the pins of which were fastened with cotters.

All of the staybolts in the side and crown-sheets were in perfect condition. There was not one that had been broken and all were pulled out of the sheets when the latter stripped away. Two staybolts had been broken off near the outer sheet, but it seems that these must have been broken since the explosion, as the metal was bright and clean, without any indication of a crack or flaw and showing a fine smooth crystaline structure across the whole section. These bolts were those in the right side in the eighth and ninth rows from the front, and the tenth



Boiler 2795, Rear End. Boiler Tipped Over on Left Side.

and ninth rows, respectively, from the bottom. The tell-tale holes in all of the staybolts were clean and entirely free from any indication of scale.

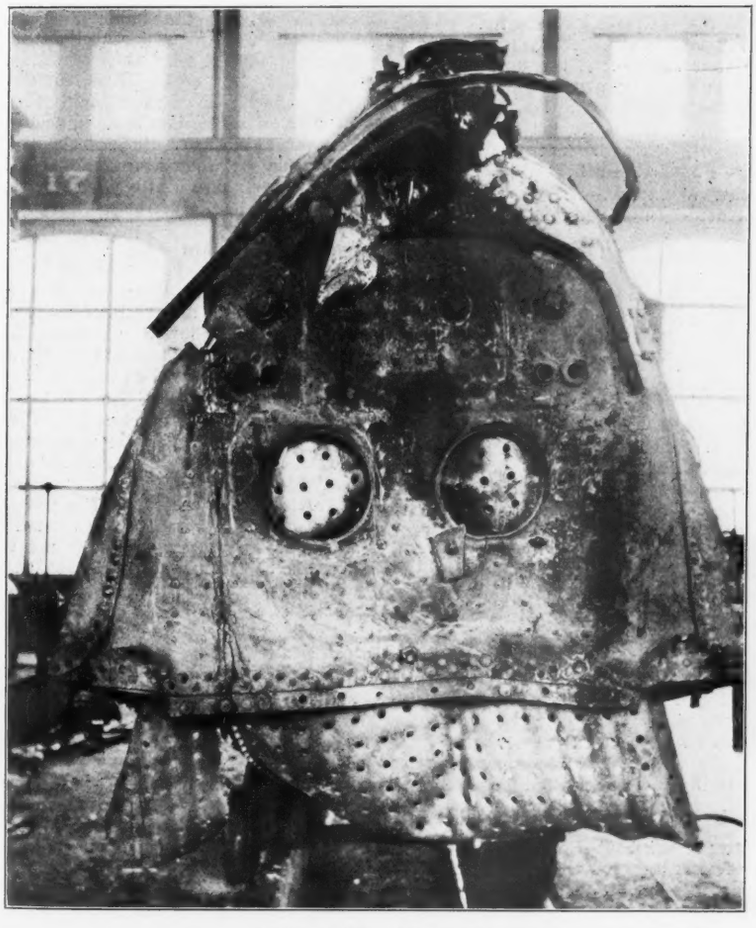
The tubes, except those torn from their place in the upper part of the back tube-sheet that came down with the crown-sheet, were all intact and in perfect condition, the beading well rounded out and the ferrules tight, except in four or five cases where the ends of the tubes had been cut by the edge of the broken sheet as it passed. The riveting in nearly all the seams is also intact and uninjured and these seams show no evidence of leaking, as the metal is clean. An exception to the perfect intactness of the rivetting is at the forward left corner, where 11 rivets are torn out between the crown and side sheets. A few rivets were also torn out at the corners of the mud ring at the back. The fractured part of the side and tube sheets shows a breaking or tearing through thick, firm metal that had no indication of a preliminary fracture having existed. In fact, the metal of the back tube sheet between the tubes that were left in place was clean and bright as though freshly broken at the time of my investigation. That of the side sheets and other parts that had been exposed to the weather was slightly rusted, but the metal bore every evidence of having been firm at the time of the explosion. Further, the metal was distorted between the tubes and the stays in a manner that would have been impossible with anything but first class material.

The mud ring was broken in five places: at each side of the two back corners and near the center of the back section, as indicated in Fig. 2, the point in the back part being directly beneath the right-hand fire door. The progress of the explosion was probably as follows:

The upper front end of the crown-sheet was slightly higher than the back, and became overheated to such a degree that when the ends of the sling stays were burned it was stripped from them in one of the three front rows and to the left side of the center. The front end then came down, bending and tearing the tube sheet to a point near the center of the third row of tubes, when it broke loose, stripping across from side to side, reaching the left side first and then stripping down the side sheets diagonally as shown in the engraving, as one tears a piece of paper, until the crown-sheet was all clear of its stays. Then the back end presumably let go at the top row of staybolts and bending back on itself permitted the crown-sheet to flatten out against the inside and close the door openings. At the end the rivetting between the crown and side sheets was intact and unbroken.

As to the behavior of the boiler after the explosion there is little that can be said with certainty. Evidently the back end started into the air first and tearing itself from the saddle went through the air, revolving about a lateral axis. It seems that it struck the ground at the front end, collapsing the smoke-box, as shown in the general illustration, since the back ends are folded back in a way that would be expected if such were the case. It apparently slid

General View of Wreck.



Boiler 2795. Rear End.

a short distance on its end, as the distinct impression of a rail at this point indicates. This mark is at the edge of the saddle casting on the left hand side. It then seems to have bounded in the air and struck again on the left side of the fire-box just above the eleventh row of tubes from the bottom, where there is a deep indentation of a rail, and upon which it must have slid for some distance, since the metal is scored and peeled back to the rear as clearly shown at A, in the illustration of the back end, with every evidence of having been heated, by its blue and yellow color. The same engraving also shows a slight indentation below the right hand fire-door down to the mud ring, that seems to have been made by contact with a rail, and by which the mud ring was broken at the same time.

There can be no doubt as to what occurred in the fire-box and the sequence of events of the explosion itself. As to after events, there is room for more or less surmise, but it seems reasonably certain that the boiler sailed through the air and over at least a portion of the train that was derailed. What the result would have been had the accident occurred a few seconds earlier, and had the boiler struck the roof of one of the passing cars, instead of the track behind them, is not pleasant to contemplate. As it was, the engineer and fireman of the wrecked engine were killed and 27 passengers on the derailed train were more or less injured, as mentioned; the injuries ranging from slight bruises to severe wounds. As the two men on the engine are dead it will never be known exactly what they were busied about at the moment the crown-sheet came down, or whether they knew of its dangerous condition; the only thing that is definitely known concerning the cause—and that is known beyond all possibility of contradiction—is that it was due to low water and a hot crown-sheet.

Timber Preservation Experiments in Texas.*

With a view to testing and comparing a number of tie treating systems under circumstances which would afford results as quickly as possible, treated and untreated ties, sent from different places in the United States, were laid in a continuous stretch of track in southeastern Texas, during February, March, April and May, 1902. In the region selected, the average temperature during July and August is 94 deg., and the total average rainfall of the three summer months is about 14 in., while the average annual rainfall is more than 45 in. The following kinds of timber were used in the tests:

White oak, Missouri.	Beech, Indiana.
White oak, Illinois.	Tamarack, Wisconsin.
Red oak, Missouri.	Hemlock, Wisconsin.
Black oak, Missouri.	Longleaf pine, Texas.
Spanish oak, Missouri.	Shortleaf pine, Texas.
Turkey oak, Missouri.	Loblolly pine, Texas.
Willow oak, Missouri.	Redheart pine, Texas.

The experimental track, starting at a point east of the station of Pelican, on the Gulf, Colorado & Santa Fe, and extending westward, was completed in May, 1902. All ties of one kind of timber were laid together—for example, in the case of white oak the order was, white oak Burnettized, white oak Allardyce, white oak untreated, white oak Wellhouse, etc. In this way approximately the same conditions were obtained for the same timbers. A detailed plan of the manner in which the ties were laid is given below.

Each treated tie was marked with at least three nails. These nails were made of heavy wire coated with zinc. In the heads were stamped the letters or marks showing the kind of timber, the kind of treatment and the year in which the ties were laid. In some instances a fourth nail was added, with one or two stars, the single star indicating that the timber had been treated at Chicago, the double star that it had been treated at Beaumont, Tex. The nails were placed about 4 in. outside of the rail, on the south side of the track, where they would not be concealed by the ballast. When finished the track was heavily ballasted in the middle, leaving the ends of the ties exposed to the air. The ballast was composed largely of densely packed sand. On both sides of the track there is a continuous stretch of pine forest, by which the track is more or less shaded during the day. No tie-plates were used on the test ties. The track was laid with 60 and 61 lb. rails.

The traffic over the track is mostly in a westbound direction. For the past year the gross tonnage passing over the Beaumont division amounted to 306,000,000 tons, equivalent to about 2,000,000 tons per mile during the year, or 166,000 tons per month. The maximum wheel load per axle of locomotive passing over the track was about 35,000 lbs.

A careful inspection of the experimental track was made on Nov. 30, 1903. Each tie was examined, and notes were made as to the extent to which the ties had worn, checked, or decayed. The general condition of the track was good. Most of the ties had worn very little, and with the exception of one species of timber they had not cracked to any considerable extent. Almost all of the untreated timbers showed signs of decay, some more and some less, which indicated that the selection of this part of the country for the purpose of getting rapid comparative results was a good one.

Of the treated timbers, those treated with the Hasselmann (or Barschall) process showed some signs of decay. These were ties included in a run which was stated not to have received the proper treatment.

A certain number of ties, which had been treated by the zinc creosote process at Beaumont, Tex., but which had been subjected to an excessive heating during the treatment, had to be removed very soon after being placed. They were brittle when they arrived, and should not be considered as furnishing a fair test of the process. They really ought not to have been laid in the track at all. These ties have shown what is probably the most interesting result so far obtained from the test. It will be noted that the oak ties treated at Beaumont were treated in the same run with pine, tamarack, beech, etc., and that in all probability the high temperature to which the ties were subjected injured the oak wood materially.

The oak ties which were submitted to the overheated treatment were soft and exceedingly brittle when they reached the place where they were to be laid. A number of them were broken when thrown from the cars. The remainder, both of those which have been removed and those which are now ready to be removed from the track, have all been broken and shattered, indicating that during the process of treating the strength of the timber had been materially affected. The results of the test should serve as a warning to all who are interested in the treatment of timber to avoid the excessive heating of the wood while it is in the cylinder.

The following is a detailed statement of the number and condition of the ties in the experimental track at the time of inspection.

Beech, untreated.—Of the 87 untreated sawed beech ties laid, 38 had fungi on them. Of these fungi the most common is the grayish white fungus (*Polystictus versicolor* Fr.) often found on beech wood throughout the beech-growing belt. In most cases the fungi were growing with considerable vigor, and covered the entire end of the tie. The fact that fungi have attacked such a large number of ties shows that the untreated beech timber is decaying with great rapidity, and it is probable that within another year practically all of the untreated beech ties will be partially decayed. The ties have worn but little under the rail.

Beech, Wellhouse.—All of the 100 hewn ties treated by the Wellhouse process at Chicago were in excellent condition, and showed very little wear.

Beech, Burnettized.—The 99 sawed beech ties treated at Chicago with zinc chlorid were all in good condition, and showed very little wear.

Beech, Barschall.—Of the 98 sawed beech ties which received the Barschall treatment at Somerville, 20 had the grayish white fungus (*Polystictus versicolor* Fr.) growing on the ends. This indicates that they are beginning to decay. The ties show but little wear.

Beech, Allardyce.—The 50 beech ties treated at Somerville by the Allardyce process are in an excellent state of preservation, and show but little wear.

Beech, zinc creosote, overheated.—There are also 50 sawed beech ties which were treated by the zinc creosote process at Beaumont, but were subjected to an unusual degree of heat. Many of these ties were badly cracked and shattered, and many of them will have to be removed in the near future. Without doubt the extreme heat to which these ties were subjected during the treatment is the reason for their being so badly broken.

Red oak, Burnettized.—The 20 hewn red oak ties treated at Somerville with zinc chlorid were in good condition and showed very little wear. Some of them are very badly checked.

Red oak, Burnettized.—A second lot of 86 sawed 7 by 8 red oak ties, treated at Chicago, were likewise in excellent condition so far as preservation is concerned.

Red oak, untreated.—Of the 93 untreated red oak ties, 16 had the timber-destroying fungus (*Polystictus versicolor* Fr.) on them, and 23 were very badly split, probably because of unequal drying out.

Red oak, Barschall.—The 19 hewn red oak ties treated by the Barschall process were all in good condition, and showed little wear.

Red oak, Wellhouse.—All of the 20 hewn red oak ties treated by the Wellhouse process at Somerville were in good condition, and showed little wear.

Red oak, Allardyce.—The 10 hewn red oak ties treated by the Allardyce process were in a splendid state of preservation, and showed neither wear nor checking to any considerable extent.

Turkey oak, untreated.—Out of the 20 hewn turkey oak ties, six had the gray fungus (*Polystictus versicolor* Fr.) growing on them, indicating that they are beginning to decay. The ties are wearing well.

Turkey oak, Wellhouse.—There are 20 hewn turkey oak ties which were treated by the Wellhouse process at Somerville. Both the wear and the preservation are good.

Turkey oak, Barschall.—The 19 hewn turkey oak ties treated by the Barschall process were all in a good state of preservation, and showed little wear.

Turkey oak, Burnettized.—The 20 turkey oak ties treated at Somerville with zinc chlorid were all well preserved, and showed even less wear than most of the other oaks.

Turkey oak, zinc creosote.—Ten turkey oak ties treated at Beaumont by the zinc creosote process were overheated. These ties are considerably split, but they showed good wear and no signs of decay.

Turkey oak, Allardyce.—The 10 turkey oak ties treated by the Allardyce process at Somerville were found in excellent preservation, and showed very little wear.

Hemlock, untreated.—Of the 101 untreated hewn hemlock ties, 90 had fungi growing on the ends, in some cases to an unusual extent. The very high percentage of hemlock ties with fungi is a striking indication of the comparatively poor lasting power of this class of timber. For illustrating the preserving effect of treatment hemlock will be one of the most important woods.

Hemlock, Wellhouse.—The 100 hewn hemlock ties given the Wellhouse treatment at Chicago were in an excellent state of preservation, but showed considerable wear under the rail. It should be remembered that no tie-plates were used on these ties.

Hemlock, Allardyce.—The 50 hewn hemlock ties which were treated by the Allardyce process at Somerville were sound, but showed about as much wear as the untreated ties.

Hemlock, zinc creosote.—The general condition of the 49 hemlock ties treated by the zinc creosote process, with the use of English oil, at Beaumont, Tex., was good, but they showed wear to the depth of about half an inch.

Hemlock, Barschall.—Of the 100 hewn hemlock ties treated by the Barschall process, 32 ties had fungi—some a very few, others more. Four have the brown rot fungus (*Lenzites sepiaria*) and 28 a gray fungus (*Schizophyllum commune*). Most of these ties have worn well.

Hemlock, Burnettized.—The 100 hewn hemlock ties treated with zinc chlorid at Chicago showed but little wear, and were perfectly sound.

Shortleaf pine, Burnettized.—There are 100 sawed 6 by 8 shortleaf pine ties which were treated at Somerville with zinc chlorid.

*Abstract of a report on the condition of treated timbers laid in Texas, February, 1902. By Hermann von Schrenk. Published by the Bureau of Forestry.

These were all in good condition, and showed very little wear.

Shortleaf pine, zinc creosote.—All of the 50 sawed 6 by 8 shortleaf pine ties which were treated by the zinc creosote process were found in good condition, except that one had a bad check.

Shortleaf pine, Allardyce.—There are in addition 50 shortleaf pine ties sawed 6 by 8, which were treated by the Allardyce process at Somerville. These likewise were in an excellent condition. They showed very little wear.

Shortleaf pine, Barschall.—Ninety-eight sawed 6 by 8 shortleaf pine ties were treated by the Barschall process. Their general condition was good, except that they showed considerable wear—as much as half an inch in certain cases.

Shortleaf pine, Wellhouse.—The 100 sawed 6 by 8 shortleaf pine ties treated at Somerville by the Wellhouse process were in an excellent state of preservation, and showed a maximum wear of about a quarter of an inch.

Shortleaf pine, untreated.—In the case of the 100 sawed 6 by 8 untreated shortleaf pine ties, 31 had the brown fungus (*Lenzites sepiaria*) growing on the ends, chiefly on the sapwood. The ties had worn but little.

Longleaf pine, untreated.—Of the 93 untreated longleaf pine ties, 68 had the brown fungus (*Lenzites sepiaria*) growing on them, and some are very badly decayed. This is all the more surprising in view of the fact that the longleaf pine is supposed to be a more resistant timber than the other pines. The ties showed very little wear.

Longleaf pine, Wellhouse.—All of the 100 sawed longleaf pine ties treated at Somerville by the Wellhouse process were in excellent condition, and showed very little wear.

Longleaf pine, Barschall.—There are 100 longleaf pine ties treated by the Barschall process. All were in good condition, and showed very little wear.

Longleaf pine, Allardyce.—The 50 sawed 6 by 8 longleaf pine ties treated by the Allardyce process were generally in good condition.

Longleaf pine, zinc creosote.—There are 50 longleaf pine ties treated by the zinc creosote process which were overheated. One of these was badly broken, and others showed signs of giving out. This again is an instance of the weakening of the timber by excessive heat.

Longleaf pine, Burnettized.—The 100 sawed longleaf pine ties treated at Somerville with zinc chlorid were in excellent condition, and showed very little wear.

Longleaf pine, Beaumont oil.—There are 100 hewn longleaf pine ties which were soaked in Beaumont oil. They were in good condition, and had worn as much as, but no more than, the other longleaf ties.

Longleaf pine, zinc chlorid and Beaumont oil.—One hundred longleaf pine ties were treated with zinc chlorid and subsequently with Beaumont oil. They are in good condition, and show very little wear.

Longleaf pine, spirittine.—The 100 longleaf pine ties treated with spirittine were all in excellent condition, and showed very little wear.

Loblolly pine, untreated.—Of the 100 loblolly pine ties untreated, 57 had large numbers of fruiting bodies of the brown fungus (*Lenzites sepiaria*) growing on the ends. The poor lasting qualities of the loblolly pine in this region are well known.

Loblolly pine, spirittine.—The 100 loblolly pine ties treated with spirittine were generally in good condition, but small fruiting organs of the gray fungus (*Schizophyllum commune*) were growing on three or four of them.

Loblolly pine, Beaumont oil.—There are 42 loblolly pine ties treated with Beaumont oil. On four of these the fruiting bodies of the brown fungus (*Lenzites sepiaria*) had appeared. The remainder were in excellent condition, and showed hardly any wear.

Loblolly pine, zinc chlorid and Beaumont oil.—Eighty ties were treated with zinc chlorid and subsequently with Beaumont oil. All of these were in excellent condition, and showed very little wear.

Loblolly pine, Burnettized.—All of the 100 loblolly pine ties treated with zinc chlorid at Somerville were in excellent condition, and showed wear not exceeding one-fourth of an inch.

Loblolly pine, Wellhouse.—The 100 loblolly pine ties treated at Somerville by the Wellhouse process were found in excellent condition, and showed no wear exceeding one-fourth of an inch.

Loblolly pine, Allardyce.—The 50 loblolly pine ties treated by the Allardyce process were in good condition, and showed little wear.

Loblolly pine, zinc creosote.—Fifty-one loblolly pine ties were treated by the zinc creosote process, using oil at a high temperature. There were no signs of decay, but many of the ties were badly worn.

Loblolly pine, Barschall.—The 99 loblolly pine ties treated by the Barschall process were generally in good condition, and showed no wear greater than a quarter of an inch. A few of them are somewhat checked.

Redheart loblolly pine, Barschall.—There are 100 sawed loblolly pine ties, which were decidedly redhearted timber, treated by the Barschall process. These were found in an excellent state of preservation, but many of them had deep cuts under the rail and several were badly split. There was no sign, however, that the decay, which started in the tree before the tie was cut, was progressing.

Tamarack, Barschall.—On the ends of five of the 98 tamarack ties treated by the Barschall process fungi were growing. The ties showed a medium amount of wear, in some instances as much as half an inch, but their general condition was good.

Tamarack, Allardyce.—There are 50 tamarack ties treated by the Allardyce process. They showed no signs of decay, but were considerably worn.

Tamarack, zinc creosote.—There are 51 tamarack ties treated with zinc creosote. These are part of the lot which was badly burned during the treatment. They showed considerable wear, and many of them were badly split.

Tamarack, Burnettized.—All of the 49 tamarack ties treated at Chicago with zinc chlorid were in excellent condition, although some showed considerable wear.

Tamarack, Wellhouse.—The 100 tamarack ties which were treated by the Wellhouse process at Chicago were in an excellent state of preservation, and showed less wear than the other tamarack ties.

Tamarack, untreated.—Of the 49 untreated tamarack ties, 37 had the brown fungus (*Lenzites sepiaria*) growing on the ends. A large percentage were very badly decayed. It is probable that the majority of them will have to be taken out in the course of another year.

Spanish oak, Barschall.—All of the 20 Spanish oak ties treated by the Barschall process were in excellent condition, with little indication of wear.

Spanish oak, Burnettized.—The 20 Spanish oak ties treated at Somerville with zinc chlorid were in excellent condition, and showed very little wear.

Spanish oak, Wellhouse.—There are 20 Spanish oak ties which were treated at Somerville by the Wellhouse process. All were in excellent condition, and showed very little wear.

Spanish oak, Allardyce.—The 10 Spanish oak ties treated by the Allardyce process at Somerville were in excellent condition, and showed little wear.

Spanish oak, zinc creosote.—There are 10 of these ties, which were part of the lot treated at a high temperature. Most of them are badly shattered and split.

Spanish oak, untreated.—Of the 20 untreated Spanish oak ties, nine had fungi, which, however, do not seem to have injured the ties to any great extent. The wear is good.

Willow oak, Barschall.—The 20 willow oak ties treated by the Barschall process were in excellent condition.

Willow oak, untreated.—The 21 untreated willow oak ties were generally in excellent condition. One tie had a small fungus at one end.

Willow oak, Wellhouse.—All of the 20 willow oak ties treated at Somerville by the Wellhouse process were in excellent condition.

Willow oak, Allardyce.—The 10 willow oak ties treated by the Allardyce process at Somerville were in excellent condition.

Willow oak, zinc creosote.—There were 11 of these. They are part of the lot which was overheated in treatment. Most of them are badly shattered, and will probably have to be removed before long.

Willow oak, Burnettized.—The 20 willow oak ties treated at Somerville with zinc chlorid were in excellent condition, and showed very little wear.

White oak, Burnettized.—There are 100 white oak ties which were treated with zinc chlorid at Somerville. All of these were in excellent condition, and showed very little wear or splitting.

White oak, Burnettized.—An additional 100 white oak ties, treated with zinc chlorid at Chicago, were also in excellent condition, and showed very little wear or splitting.

White oak, Allardyce.—There are 100 white oak ties which were treated by the Allardyce process at Somerville. Some of these are badly split, but none of them were decayed or badly worn under the rail.

White oak, zinc creosote.—Out of 107 of these ties, which were part of the lot excessively heated during treatment, 45 have been or are being removed, because they are so badly broken as to make the track unsafe. Those that are still in the track are badly shattered and broken, and most of them will be removed in the near future. In addition to the breaking, the rails have cut deeply into the wood. This lot of ties is certainly a striking illustration of what ought not to be done in treating timber.

White oak, untreated.—There are 196 untreated white oak ties. Twelve of these had a gray fungus on the ends (*Polystictus versicolor* Fr.) when inspected. Most of the ties were in a fair state of preservation.

White oak, Wellhouse.—All of the 100 ties of white oak treated at Somerville by the Wellhouse process at Chicago were in excellent condition, showing practically no wear.

White oak, Wellhouse.—The 100 white oak ties treated by the Wellhouse process at Chicago were in fine condition, showing no wear.

White oak, Barschall.—One hundred and ninety-six white oak ties treated by the Barschall process were laid, seven of which have since been taken out to make room for a cattle guard. Those which remain showed very little wear, but five of them had fungi growing on the ends.

Black oak, Barschall.—There are 118 black oak ties which were treated by the Barschall process. Twenty-five had small fungi on the

ends, and three of them were badly rotted at one end.

Black oak, Wellhouse.—The 13 black oak ties treated at Somerville by the Wellhouse process were in excellent condition, and showed little wear.

Black oak, Wellhouse.—The 86 black oak ties treated by the Wellhouse process at Chicago were in excellent condition, and showed little wear.

Black oak, Burnettized.—The 34 black oak ties treated at Somerville with zinc chlorid were in fine condition, and showed very little wear.

Black oak, Allardyce.—Most of the 60 black oak ties treated by the Allardyce process at Somerville are badly checked, but they showed very little wear.

Black oak, zinc creosote.—There were 76 black oak ties treated by the zinc creosote process and English oil which were part of the lot heated to a high temperature. Thirty-two of these have been removed, because they were so badly broken as to make traffic unsafe. They have been replaced with cypress ties. The remainder are badly split and shattered, and will be removed this year.

Black oak, untreated.—The 25 untreated black oak ties showed no signs of decay, and very little wear.

Black oak, Wellhouse.—There are 20 black oak ties treated at Somerville by the Wellhouse process in addition to those previously mentioned, all of which were in excellent condition and showed no wear.

Automatic Couplers in Europe.*

BY G. NOLTEIN.†

In accordance with the usual custom the author of this report sent out a list of questions relating to the subject in hand to all of the principal railroads in Europe. The answers received from the different roads can be divided into four classes:

1. The first includes the roads which have not yet investigated the subject and have accordingly not yet made any trials of, or used any automatic couplers. Among them are most of the Russian railroads, the Danish State and the Norwegian State railways, the railroads of Portugal and colonies, the Italian railroads and others. The Italian Mediterranean Railway does not even believe that there is any practical solution for European rolling stock.

2. The second class includes those roads to which the question is of sufficient interest either to investigate it or to follow attentively what is done in this way by other roads. To this class belong the Paris-Lyons-Mediterranean, the French Eastern, the Orleans, the St. Gothard, the Kaschau-Oderberg, the Pekin-Hankow and other railroads.

3. The third class includes the railroads forming the *Verein deutscher Eisenbahnverwaltungen* (German Railway Union), which has appointed a special committee to examine the best designs proposed up to date, and to test them in practice. These trials, however, have not yet given definite results as to the best system to adopt during the transition period; the last of these trials were carried out quite recently in Bavaria. It is to these trials that the German, Austrian and Dutch railroads refer the reporter.

4. The fourth includes the roads which, after having made trials, proceeded to apply automatic couplers in practice. This class consists of only one railroad, the Moscow-Kazan Railway (Russia).

The application of automatic couplers has generally the double object, first of avoiding the frequent accidents which occur during shunting operations, and secondly, of materially increasing the strength of the couplers. In practice, the solution of this double problem has not been achieved up to date except in the American device known as the Master Car Builders' coupler, or the M. C. B. automatic coupler; but unfortunately the use of this ingenious apparatus involves a very appreciable increase in the dead weight, and the smaller the capacity of the vehicle the greater the resulting disadvantage. This fact by itself suffices to explain the conviction which most locomotive engineers in France and in England share, that the general application of M. C. B. couplers to the existing rolling stock would be an absolutely ruinous proceeding for railroad companies, on account of the enormous resulting expense and of the increased dead weight of the vehicles. The same reasons appear to have had a certain weight even in Russia, where, however, the minimum capacity of goods wagons is at present 27,560 lbs.; and it is from this point of view, that the management of the Moscow-Vindau Railway has undertaken a series of trials with the Piotrovsky coupling, which has as its object automatic coupling up by means of an ordinary screw coupling.

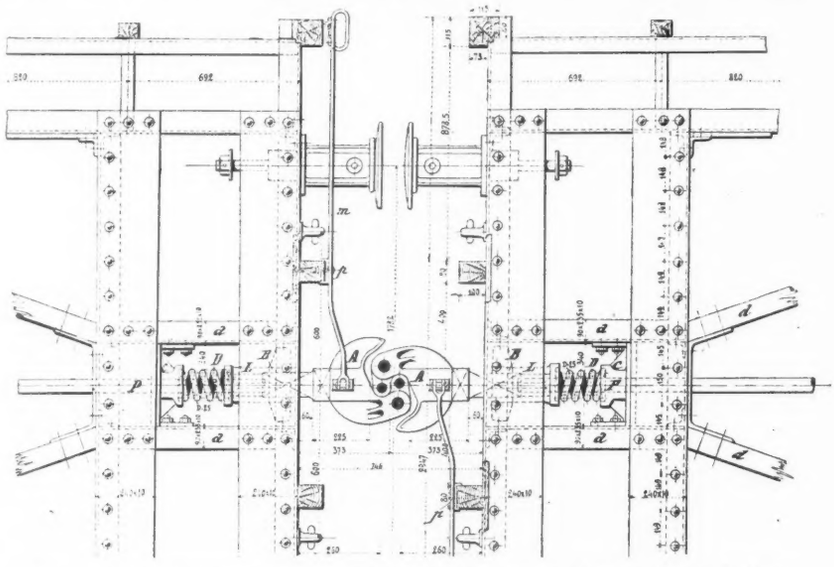


Fig. 1—Early Arrangement of Automatic Couplers on Moscow-Kazan Railway.
Coupling Two Cars with Automatic Couplers.

But the subject assumes quite a different aspect when it becomes a question of very materially increasing the carrying capacity of a railroad and of enabling it to meet the requirements of a constantly developing traffic while at the same time reducing the cost of transportation. The maximum pull possible, which is limited by the strength of the hooks and screw couplings to about 26,460 lbs., prevents any increase in the train loads and also prevents the use of more powerful locomotives. The consideration of the question of increasing the strength of the standard European coupling, by the German Union, led to the following conclusion already quoted at the last session of the Congress: "It is hardly advisable to increase the weight of the screw coupling by increasing its dimensions, without also increasing the section of the drawhook at the same time and to a corresponding extent." The trials made in Russia, of increasing the section of the drawhook, have proved that this change cannot be conveniently made without at the same time increasing the amount the hook projects, and this consequently necessitates alterations in other dimensions of the coupling and even involves an increase in the length of the buffers. On the other hand, experience shows that any increase in the weight of the screw coupling involves an extra and very fatiguing amount of work on the part of the employees. The consequent conclusion arrived at was that the maximum pull which could be provided for by increasing the strength of the existing coupling would not exceed 30,860 lbs., whereas in the case of the coupling in use the conclusion of the German Union was that under normal running conditions the pull on the coupling must not exceed 22,050 lbs. But the author, who has studied the question both in Russia and in America, is convinced that neither a pull of 30,860 lbs. nor one of 22,050 lbs. is enough to make it possible to realize any material saving in the goods service of railroads.

The greater each individual train load on a given line, the smaller the cost of working and the more profitable the line as a whole. The increased capacity of a line which results from heavier train loads, is only attended with a very small increase in expense, particularly when the length of the trains is not much increased. On the other hand, the solution generally adopted in Europe, namely, that of increasing the number of the trains without increasing the train loads, is not only very much more expensive, but is also attended with serious disadvantages; there has to be a continual increase in the number of sidings and of men employed, trains have to stop more frequently and consequently the annual mileage of the rolling stock is reduced; and all this, although it makes it possible to deal with a larger amount of traffic, only results in a very slight reduction in the cost per ton-mile, or even in none at all. More careful investigation of the question proves that an increase in the paying load per train has a much greater influence on the economy of the service than a reduction in the dead weight as compared with the paying load per car.

It follows from the preceding considerations that roads on which it is an absolute necessity to reduce the cost of transport, can only consider the subject from the double point of view of the safety of the employees and of the increased tractive effort. Consequently, as the solution of this double problem cannot be obtained by strengthening the European couplings (as experience has proved), it must, therefore, be sought in an application of the American system, capable of giving the desired result, to the most complete extent. As German and Russian lines are the ones which, owing to sundry eco-

*Abstract of a report to be presented to the International Railway Congress to be held in Washington, D. C., May, 1905.

†Member of the Managing Council of the Moscow-Kazan Railway.

nomic conditions in those countries, are compelled to look forward to reductions in the rates, it is quite natural that the first experiments should be made in those countries.

One part of the trials made in Germany has already been reported on by Mr. Victor Schützenhofer at the last session of the Congress. In this interesting report, the arrangement adopted by the Bavarian State Railway is described; it consists of an American coupler fixed below the frame, the center of the knuckle of the coupler projecting $^{19}/_{32}$ in. beyond the face of the buffers when not compressed. The regular coupler remains in its ordinary position, but the screw coupling is done away with so that in coupling up with vehicles of the old type the screw couplings of the latter are used. The Royal Erfurt Management adds a bridle fixed to the coupler and having a hook to act as a safety fastening. As Mr. Schützenhofer's report explains, after a number of different trials had

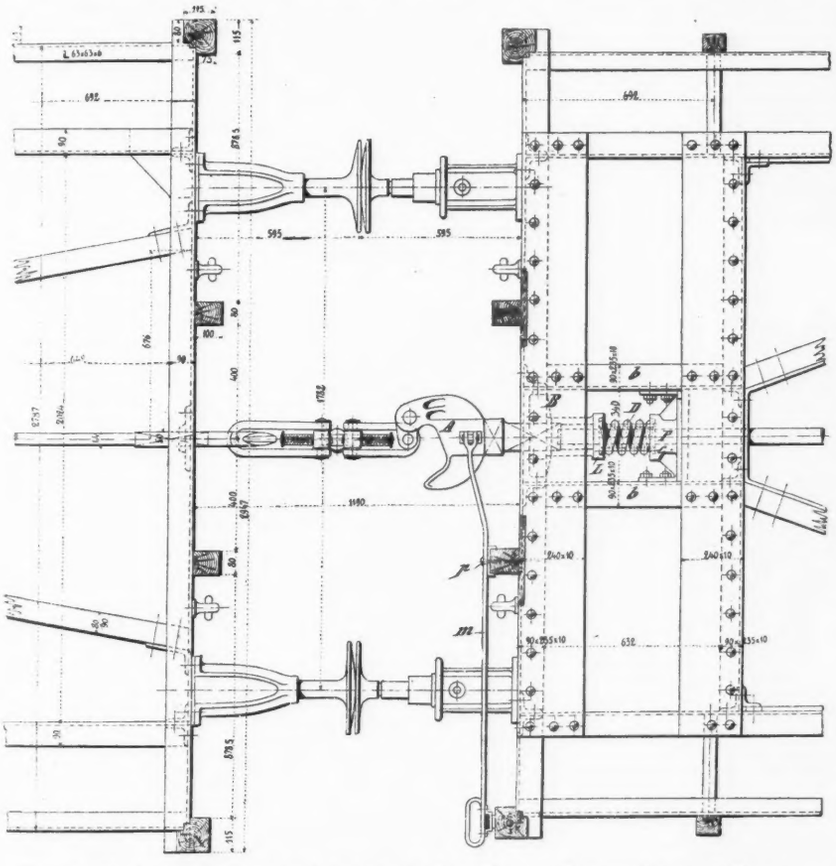


Fig. 2—Early Arrangement of Automatic Couplers on Moscow-Kazan Railway.

Coupling Automatic Coupler with European Screw Coupling.

been carried out by several roads belonging to the German Union, and more particularly as a result of the favorable results which had been obtained experimentally by the Bavarian State Railway with the Janney coupler, the Technical Committee decided to request all of the railroads belonging to the Union to fit a sufficiently large number of vehicles with American automatic couplers and to make as thorough trials as possible with them. It was proposed to deal with the question of the general adoption of automatic couplers on the basis of the results so obtained.

The following programme was submitted to the different managements of the railroads belonging to the Union as a guide in carrying out these trials:

(a) The shape of the coupler head must approximate as closely as possible to the standard pattern recommended by the American Master Car Builders' Association.

(b) The distance between the center of the head and that of the drawhook shall be 240 millimeters ($9^{7}/_{16}$ in.).

(c) The center of the surface of contact of the head (of the knuckle) shall project 15 millimeters ($^{19}/_{32}$ in.) beyond the faces of the side buffers (buffers not compressed).

(d) The travel of the spring of the automatic coupler shall amount to from 50 to 100 millimeters (2 to 4 in.).

(e) The lateral play of the coupler head shall not amount to more than 75 millimeters ($2^{23}/_{32}$ in.) on either side.

The type used by the Bavarian State Railway and the coupler head worked out by the Erfurt Management, were to serve as patterns as far as the general arrangement of the apparatus was concerned. In the Bavarian coupler, the head and the hollow drawbar were in one piece; in the Erfurt pattern, they formed two separate pieces which were connected by a strong bolt. In the case of the latter pattern, it was more practicable to make the coupler heads of mild steel. The roads belonging to the Union were strongly urged to carry out these experiments; reports, with drawings, were to be submitted on July 1, 1900. The Technical Committee, moreover, expressed the opinion that double couplings could be dispensed with in the case of the experimental wagons, and that these could be used without inconvenience for goods trains.

The results obtained on the German lines were made the subject of a paper read by Mr. Sauer on Oct. 28, 1902, before the German Institution of Mechanical Engineers; a fairly complete summary of this paper was published in the *Bulletin of the International Railway Congress*, August, 1903, p. 771.

The different methods by which the American coupler was adapted to the European wagons may be classified under different types, of which the principal ones are:

1. Automatic coupler fitted below the underframe, as described above.

2. Coupler with head pivoted about a horizontal or vertical axis (Grimme and Weddingen system).

3. American head fitted in the central plane of the underframe and having a bridle with a link for the hook of an adjoining wagon to couple into.

4. Hook and head rigidly attached to each other and rotating in the central plane of the underframe.

5. Head passing over (enveloping) hook.

6. Provisional use of a shortened coupling or of a link, as was done in America during the transition period.

7. Interchangeable arrangement, secured to the drawbar of a combined draw and buffing gear previously fixed to the wagon. The application of this last type makes it necessary for the drawbar to have a drawhook and ordinary coupling during the transition period. Once all the stock is fitted, the drawhooks are replaced by the automatic coupler heads in a few days. It is evident that the heads pivoted at a right angle can be utilized in a similar way if during the transition period only the ordinary screw coupling is used, the head being swung to the side.

The Moscow-Kazan Railway, having recognized the urgent necessity of strengthening the drawgear so as to increase the paying load of their trains gradually to 1,000 tons, proceeded to the investigation of the subject in 1898.

The principles adopted by this road in the construction of transition appliances, differed, however, from those of the German Verein although the same object was aimed at. These principles were:

(a) The transition must be effected in one single period; and consequently the American coupler head must be fitted in its definite final position.

(b) The center of the coupling must be in the same horizontal plane as the center of the underframe.

(c) In order to avoid possible and even very probable errors which might result if a new shape of coupler head were adopted, the shape must be exactly that specified in the rules approved by the Master Car Builders' Association (the M. C. B. type).

(d) The travel of the coupler head, which in America is fixed at 1¾ in., must be increased to from 2⅜ to $2^{7}/_{16}$ in., in order to increase the elastic work of the draw-springs which also act as buffer springs.

(e) As the substitution of American automatic couplers in place of the old screw couplings gives rise to considerable expense, it is absolutely necessary that the lines which adopt this alteration should from the beginning gain some advantage from it.

From this point of view, the appliances of Class 7 (interchangeable appliances) can hardly be recommended, for it is not until the whole rolling stock has been fitted, that is to say, not until millions have been spent during a number of years, that a profit will begin to be made.

As the conceptions of the management of the Moscow-Kazan Railway differ largely from the rules enunciated by the Committee of the *Verein*, it will be useful to compare them, and in the opinion of the reporter, this comparison will enable one to form definite ideas on the subject. This appears to be all the more necessary because the German rules are the result of the examination of the subject by a commission of distinguished specialists.

We will begin by examining important divergencies:

(1) Rule c specifies that the center of the contact surface of the head (of the knuckle) is to project $^{19}/_{32}$ in. beyond the

faces of the side buffers, the buffers not being compressed. It is however evident that if this proviso is carried out, the head of the coupler will be in an absolutely faulty position, whereas the first condition specified by the Moscow-Kazan Railway ensures one distinctly better. In the case of the latter (Figs. 1 and 2) the overhang of the coupler head is materially reduced, and the result is that there is a material reduction in the stresses to which the metal of the drawbar is subjected at the point where it leaves the underframe, particularly when the coupler also acts as buffer. In addition, any reduction in the overhang reduces the lateral displacement on curves and the stresses which result from it. But the chief advantage resulting from a reduced overhang, is that the length of track occupied by each vehicle is appreciably reduced, and this makes it possible to increase the load of a train of given length. At the same time, the mutual approach of the side walls of the wagons results in reducing the air and wind resistance. Experience moreover shows that if the overhang is increased the head of the coupler will sag down if the drawbar is not very well guided. This makes it necessary to increase the length of the drawbar, and this adds materially to the weight.

(2) Rule b fixes the distance between the center of the coupler head and the horizontal plane through the middle of the underframe at 240 millimeters ($9^7/_{16}$ in.). This rule has been discarded by the management of the Moscow-Kazan Railway as also being objectionable, and it is to be noted that according to Mr. Sauer's report this opinion begins to gain ground among German experts. The most striking argument in Mr. Sauer's report, which tends to prove that there is a possibility of the loads on the two axles of a vehicle differing by as much as 6,610 lbs., a difference produced by the position of the coupling below the underframe, seems to lack accuracy, for he leaves the flexibility of the springs and the resulting reduction in the moment of rotation entirely out of consideration. However, this difference, while it is well under 6,610 lbs., remains very appreciable. Another defect will be described later on, when we come to consider the question of the application of automatic couplers to passenger cars. Mr. Sauer recognized the superiority of placing the coupler head in the horizontal plane through the middle of the underframe. This same superiority has also been recognized in America, where car builders are now trying to make the median plane of the underframe coincide with that of the coupler. Experience has shown that owing to the continually increasing weight of trains made up out of large capacity wagons, the coupling gear fixed below the underframe is torn away from the underframe and requires better fastenings. The arrangement of the coupling gear at a lower level results in injurious unequal stresses and also makes it necessary to construct a stronger and hence heavier and more expensive underframe.

Having thus fixed the level of the coupler head and shown that it is necessary to reduce the overhang as much as possible, we arrive at the only arrangement which combines all the points desired; it is shown in Fig. 1, which gives a plan of the underframe of two wagons on the Moscow-Kazan Railway; these two wagons form part of the first half-dozen wagons fitted with American couplers and put into use in 1897. Fig. 2 shows one of the wagons coupled up to an ordinary wagon by means of the screw coupling of the latter.

This arrangement of the coupler head makes it necessary to construct the side buffers in a special way, for these normally project 595 millimeters (1 ft. $11^7/_{16}$ in.) in Russia, whereas when the American couplers are to be used they must not project more than 260 millimeters ($10^1/_4$ in.). The arrangement of these buffers, which are capable of being pushed home, constitutes the most important point in the system adopted, and consequently was the subject of long investigation.

The type shown in Figs. 1 and 2, and applied to 30 wagons, is based on the fact that the buffer rod, the outer part of which has a rectangular section, does not bear against the washer in front of the spring except when it is in the position shown in the figure. When rotated through an angle of 90 deg., the rod no longer bears against the washer and can be pushed back without compressing the spring; it is so shown in Fig. 1. A small attachment is provided to secure the rod in each of the two positions described, without interfering with its longitudinal movement. The wagons fitted in this way have their buffers placed in the position of normal length under ordinary conditions; the rods are only rotated into the second position when two wagons fitted with American couplers come together, and then only pressure is required to couple up the two wagons.

This arrangement, although simple in principle, leaves something to be desired; the great inconvenience is that it is not always easy to roiate the rod when the buffers of two wagons are in contact. Owing to this defect, the management has begun to replace buffers of this construction by a new type worked out by the reporter, in conjunction with Mr. Sandbery, Engineer, Moscow. The mechanism is very simple to operate and gives rise to no difficulties.

According to Mr. Weddingen, Member of the Board of Works, Germany, the transition system of screw couplings using coupling pins, had the disadvantage that after the pins had been subjected to the action of more or less considerable pulls, they became deformed to such an extent that they could not be drawn out except by heavy blows with a hammer. This would lead to considerable delay during shunting operations. This disadvantage has not been observed by the reporter, and this is explained by the greater diameter of the pins used on the Moscow-Kazan Railway. Pins having a diameter of 1⅝ in. were used for the tests from the beginning. Moreover, the holes for the pins being reamed out with taper reamers, the orifices are a little larger at the top and bottom surfaces than at the intermediate surfaces where the slot for the knuckle is cut out. The result of this is that even in the exceptional case of a pin being bent, it is still easy to remove them.

It is easy to see that the use of this coupling results in a quite appreciably increased weight. The weight of the different details is given in the accompanying table. The ordinary coupling gear of a wagon of the same length (body 36 ft. 1 in. long) would only weigh 440.57 lbs., namely:

1. Drawbar, 2 hooks and spring and accessories, but not including the buffer spring bed	338.37 lbs.
2. Two screw couplings	102.20 "
Total	440.57 lbs.

Thus not taking into consideration the difference there may be in the weight of the underframe (which in fact tends to become equal to zero when it is a question of building new underframes), the extra weight which results from the use of automatic couplers is 865 lbs.

Name of Part.	Material.	Weight, in lbs.
Coupler head A	Steel cast'g	144.450
Knuckle	" "	68.614
Front guide C	" "	74.030
Back guide D	" "	80.350
Back washer, springs E	" "	25.279
Three springs	"	67.169
Drawbar H	Iron	47.669
Sleeve of drawbar	"	10.473
Three bolts for the springs	"	15.167
Two bolts, holding guides	"	39.724
Front plate of springs E	Steel cast'g	25.279
Locking pin*	" "	10.834
Locking pin link	Iron	1.445
Trigger for locking pin	"	6.500
Retain'g cotter for l'ckg pin	"	0.271
Small pin	"	1.083
Coupling pin J	"	7.223
Retaining pin	"	0.451
Uncoupling mechanism†	Iron & c.-i.	26.723
Total		652.735
Total, two couplings for a wagon		1,305.47

*Raised for uncoupling.
†Four pieces.

To this we must moreover add the difference of weight of the four special buffers which are heavier than the ordinary buffers, and this makes the total extra weight 1,353.50 lbs., as the former weigh 1,051 lbs., whereas the latter only weigh 561.91 lbs. But when the new coupling gear has to be fitted to a wagon the underframe of which does not require complete renewal, the weight is increased at least another 441 lbs. owing to the necessity of strengthening the headstocks and of adding longitudinals for fitting the drawgear. The result is the considerable increase, of more than 1,795 lbs., in the dead weight of the wagon, and a corresponding expenditure; and this expenditure would not yield any real return, from the point of view of the safety of the employees, till after a long transition period.

This question assumes, however, quite a

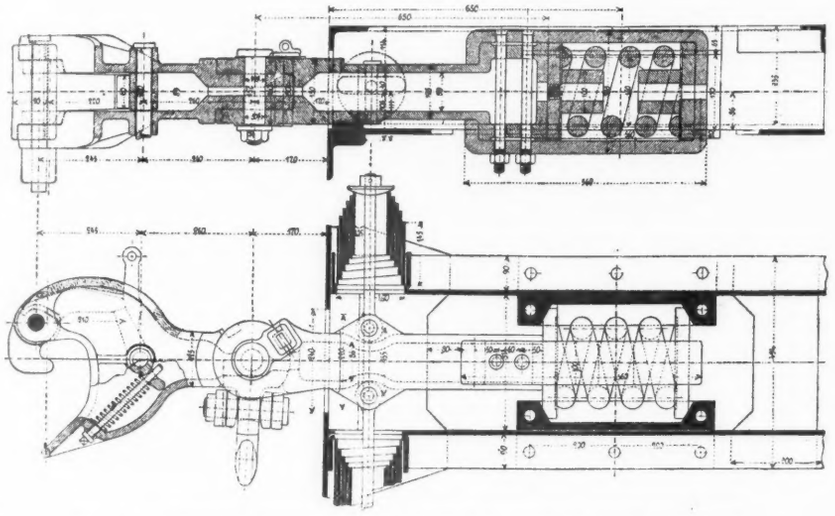


Fig. 3—Transition Coupling with Pivoted Automatic Head and Hook.

different aspect, if it is considered simultaneously with the recognized necessity of increasing the capacity of goods wagons. Ten years ago, the Moscow-Kazan Railway Company, foreseeing the absolute necessity of reducing the cost of transportation, proceeded to construct very powerful locomotives and did all it could to convince the management of the state railroads that this was the only means to adopt to avoid large financial losses. But it did so at first, unfortunately, only with very little success; and it is only recently that these ideas have begun to be received more favorably, although they are as yet by no means generally recognized. Being compelled for the time to give up the hope of seeing large capacity wagons in general use on the Russian railroads, the Moscow-Kazan Railway found itself limited to

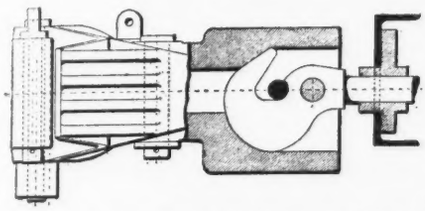


Fig. 4—Automatic Head Enveloping Hook.

proceeding to apply these innovations to the home traffic on the company's lines, or in other words to use such wagons only for traffic going as far as Moscow.

The result of the reporter's investigations was the construction of a wagon having a body with a capacity of 27 metric tons (59,525 lbs.), and weighing 12.36 tons (27,249 lbs.), without brake; that is to say, a construction for which the extra weight of 614 kilograms, 1,354 lbs., resulting from the use of American automatic couplings, particulars of the weight of which have been given, could no longer be considered as serious. For by adding 614 kilograms (1,354 lbs.), we get a total dead weight of 12,974 kilograms, (28,603 lbs.), that is not even one-half the paying load; moreover, it is to be noted that once the transition period is ended, the tare will be reduced by the weight of the four special buffers, 1,051 lbs., and the four safety chains and hooks, 103.84 lbs., that is to say by 1,154.84 lbs.

All the wagons worn out or damaged on the company's system are replaced by wagons of this type, and it will also be adopted for new stock, as soon as the state railroads cease to object to these wagons running over their lines. They already admit the large refrigerator cars intended for carrying of Siberian butter. Until then, the company will use them as at present for long distance trains running on its own lines, principally for the carriage of grain, wood, metal, stone, etc. When these wagons are placed at the head of the train, they can then be followed by the maximum number of wagons fitted with ordinary couplings without subjecting the latter to any greater stresses than are usual at present; and in this way each new wagon helps to increase the load of the train of which it forms part, thus enabling the management to advance in the desired direction without subjecting the old couplings to greater pull than on the other Russian lines.

It is true that placing the large capacity wagons at the head of the trains complicates the shunting operations, and that, in accordance with the orders issued, these wagons are shunted more carefully, that is to say, with a certain loss of time. But it must on the other hand be observed, that one of the most important points in connection with large capacity wagons is that a great economy results in shunting operations generally, and the net result is that the extra shunting operations they require are hardly appreciable.

All these considerations explain how the management of the Moscow-Kazan Railway has succeeded in observing the fifth condition it had laid down, and in order to complete this report, we still have to make sundry observations, comparing the solution adopted by this railroad with those proposed in Germany, which we have enumerated above.

The reduction in the length of the trains through the reduction in the space between the ends of the wagons varies from 5 to 6 per cent., and the corresponding increase in the load (7 to 8 per cent.) is realized without any expenditure. But if in addition, the train is made up of wagons of double capacity, one space is gained per pair of wagons, and this further increases the load by 12 per cent. But as the body of the old wagons has proved to be too long, and as the 27-ton (59,525-lb.) wagon only has a length of 11 meters (36 ft. 1 in.), inside, whereas the old body had a length of 6.444 meters (21 ft. $1^{11}/_{16}$ in.) for a capacity of 12.3 tons (27,117 lbs.), there is a further gain of 16 per cent. on the length and of 18 to 19 per cent. on the load of the trains. The net result is that for trains of equal length, one made up of new large capacity wagons, carries a load 39 to 40 per cent. heavier than one made up ordinary wagons, and it is easy to see that this must be very profitable.

All the constructions tried in Germany do not realize the advantages which result from reduced spaces between the wagons. In addition to this, Type 1 (Bavarian arrangement) presents all the disadvantages of drawgear fitted at too low a level.

Type 2 (coupler with pivoted head) reduces the danger incurred by the shunters, a danger which is common to all arrangements when the coupler head has a considerable overhang; also, as in the following types, it avoids the disadvantages which attach to couplings placed at a low level. This type is a very suitable one for tenders and is at present being studied by the reporter with a view to working out a construction to be used specially for locomotives. This construction is too heavy and too complicated to use for wagons; it also has the disadvantage of a considerable overhang which would increase the length of the trains.

Type 3 (with bridle) has the very great disadvantage that the ordinary drawhook of an adjacent carriage can be struck by the American head and that it cannot be used with an ordinary screw coupling; the junction with ordinary wagons is made by means of a special link or short coupling.

Type 4 (hook and head rigidly connected and pivoted, Fig. 3) has the second disadvantages of Type 3. Nevertheless, Mr. Sauer recommends it for passenger cars.

Type 5 (head enveloping hook) is an appliance patented by Professor J. Jedlicka, of Prague, and consists of a coupler head which can be fixed in the ordinary drawhook so that it envelopes it as in Fig. 4. This is a very faulty arrangement since the drawbar of the existing drawgear is much too weak to resist the shocks produced when American heads are coupled up together. In order to make the change, all of the wagons of a railroad system must be provided with well fitted heads, placed temporarily below the underframe. That being done, the heads must be placed on the drawhooks and the lateral buffers taken down in a few days time. Mr. Sauer remarks in his paper that this method could be improved upon by first fitting the wagons with stronger drawbars, better able to resist the shocks to which they will be subjected after the period of transition. But in this case this type will become equivalent to Type 7 and will have the same serious disadvantages to which we shall refer later on.

Type 6 uses the American heads fitted with a large overhang but placed in the central plane of the underframe. The lateral buffers are retained during the whole transition period. The wagons are coupled up to the ordinary European wagons by means of a shortened hook or a link. This transitional arrangement seems to be very similar to the one which was adopted in the United States, but in reality the conditions are very different. During the transition period in the United States, the coupling up was effected by means of the same link which formed a part of the old coupling, and which, on account of the construction of the latter, could not come uncoupled. In the case of the European rolling stock, the use of a simple stiff link between the drawhook of the next wagon and the coupling pin of the American head is almost impossible owing to the nearness of the wagons when the buffers are driven home. The construction of a shortened coupling is also attended with much difficulty and up to the present time this problem has not been solved in any satisfactory manner. Moreover, this type has all of the disadvantages of Type 3 as the American head can strike against the drawhook of the next wagon. In order to carry out a change with Type 7 (interchangeable head) all of the wagons must first be fitted with American buffing gear and drawgear having European hooks instead of coupler heads. The side buffers must also be retained. Then the transition will consist in replacing the hooks by coupler heads and removing the buffers; these operations will have to be carried out in from two to three days. The great defect of this construction has already been mentioned, namely, the absence of any saving during the long period required for fitting the drawgear to all the wagons of a railroad system. On the other hand, this system avoids the disadvantage of having a long overhang.

Another statement applies to all the constructions tried by the German Union. With

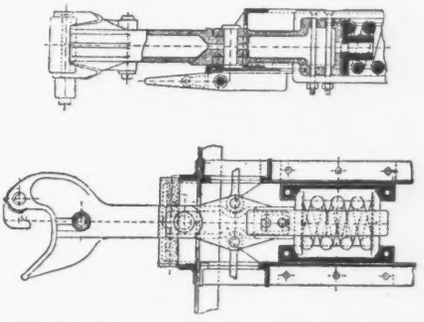


Fig. 5—Interchangeable Head Coupling.

the small travel of the American apparatus, the work taken up by the elasticity of the spring is much less than that taken up by a pair of European buffers. The American wagons are subjected to much more violent shocks than the European wagons, which are of weaker construction, could stand; particularly is this so in the case of large capacity wagons. For this reason, gear with two springs is beginning to find increasing favor in America. As Figs. 1 and 2 show, the Moscow-Kazan Railway at first also used one spring, but the later practice, in the case of the large capacity wagons, has been to use three. Owing to this, and owing to the increased travel (2⅜ in.) this gear takes up rather more work by the elasticity of the springs than a pair of buffers. A double spring has only been retained in the case of passenger carriages, for the latter are not

subjected to as hard pulls and shocks.

The detailed examination of the question of the application of American couplers to European goods wagons allows us to arrive at the following conclusions:

(1) The application of American automatic couplings to European goods wagons involves a very material increase of weight (613.94 kilograms [1,353.50 lbs.] in the case of the pattern adopted by the Moscow-Kazan Railway) due principally to additional parts made of iron and of steel castings and the change is consequently fairly expensive.

(2) The general adoption of automatic couplings on the present European rolling stock would require an enormous expenditure which would be all the more ruinous for the railroad companies, as it would involve at the same time a material increase in the dead weight of the vehicles and a certain diminution in the speed of shunting operations during a long period of transition, whereas there would not be any greater safety for the employees until about three-quarters of that period had elapsed.

(3) In those cases where part of the traffic on a given railroad system is of such a nature that it can be handled better by means of large capacity cars, the application of American drawgear to the latter must be attended with great advantages by making it possible to increase the load of trains by placing the large wagons at the head of trains.

In the case of large capacity wagons, the disadvantages connected with the use of American couplings as described above, either disappear or are more than compensated for by resulting advantages. The increase in dead weight is insignificant for it permits of carrying double the paying load. The time lost in shunting operations during the transition period is more than counterbalanced by the great advantage of handling the load of two or three old wagons in one wagon and the additional cost of the new couplers is to a large extent refunded by the extra gains due to the increased load of trains. At the same time these gains will enable the railroad companies to meet the considerable expenditure which will be involved in the gradual transformation of the present rolling stock into high capacity rolling stock and from the application of American automatic couplings to the remainder of the old rolling stock kept in use until the present couplings can be done away with.

(To be continued.)

American Railway Appliance Exhibition.

The following appeal to all concerned has been made by the General Committee of Arrangements of the American Railway Appliance Exhibition to be held in connection with the International Railway Congress in Washington next May. Applications for space at this exhibition should be made to J. Alexander Brown, Secretary and Director of Exhibits, 160 Broadway, New York.

GENTLEMEN: The Congress of the United States, with the approval of the President, has signally honored the American manufacturers of railway appliances by the passage of an Act permitting an Exhibition of the products of their factories to be made on a part of the Monument Grounds in Washington, D. C., in connection with the meeting of the International Railway Congress to continue from May 3d to 14th, inclusive, 1905.

This gracious and generous compliment by the Federal authorities, which places at our disposal a central, convenient and conspicuous site for our Exhibition, offers a supreme opportunity for the exploitation and exaltation of our craft. To improve it, is a duty; to neglect it, would be un-American.

The occasion will be unique in the annals of our industry. For a period of twelve days several hundred railway officials of high and important rank, representing many foreign countries, together with more hundreds of American railway officials of similar rank, will be gathered in Washington for the sole purpose of discussing railway problems.

In connection with this distinguished assemblage what could be more appropriate or important than an exhibition which shall show the fertility of resource, inventive genius, energy, enterprise and economic achievement of those who study with assiduity and with the zeal born of commercial ambition, the requirements of railway operations?

The members of the American Section of the International Railway Congress, are most anxious that the first meeting in America of the Congress shall be a crowning success. As an adjunct powerfully conducive to such a success, the proposed American Railway Appliance Exhibition has their cordial approval.

Your committee appeals to the patriotic impulses and commercial acumen of our fraternity to make the proposed Exhibition such a demonstration as shall command the interested attention of all railway officials, and cause to be known to the world what the American manufacturer has accomplished for the railways in solving some of their vexatious and pressing engineering and operating problems.

Your especial attention is called to the fact that the delegates to the International Railway Congress are being chosen from the Executive, Operating, Mechanical and Maintenance of Way officials. All departments with which supply men have dealings will be represented.

While the Exhibition will offer exceptional advantages to those who seek export trade, it cannot be too forcibly stated that those who manufacture exclusively for American trade will have an opportunity to gain the attention of a larger number of American Railway officials than has heretofore been enjoyed at any similar exhibition.

The Director of Exhibits has been authorized by the committee to invite applications for membership and for exhibit space under certain rules and regulations prescribed by the committee, which are fully set forth in the Director's circular, and it is our earnest hope that the responses thereto will be prompt, and in such numbers as shall show enthusiastic concert of action, and that a happy issue of our undertaking shall be quickly assured.

Again you are reminded that the funds subscribed by you will be disbursed with due heed to proper economy in keeping with such a great and dignified enterprise, and that no member of the committee or any officer thereof is to receive any monetary compensation for his services. It will be compensation enough for your servants on the committee if their efforts shall redound to the general welfare of the industry they seek to serve.

The fees for membership and for exhibit spaces have been fixed by the committee at figures to insure financial solvency beyond a peradventure. A deficit would be disgraceful and must not occur; a surplus can readily be returned pro rata to those contributing, and would be so distributed.

Finally, the appeal is made for exhibits—fine ones, impressive ones. Anyhow, whether you exhibit or not, you are urged to enroll as members, as upon the fund raised from membership fees the proper and adequate administration of the Exhibition and the entertainment of the visitors thereto, depends.

Now, gentlemen, the preliminary arrangements and our appeal for co-operation having been made, the fate of the Exhibition—its success or failure—rests with you.

Fraternally yours,

H. P. BOPE, Vice-President Carnegie Steel Co.
L. F. BRAINE, General Manager Continuous Rail-Joint Co.
A. E. BROWN, Vice-President Brown Hoisting Machinery Co.
J. B. BRADY, Vice-President Standard Steel Car Co.
O. H. CUTLER, President American Brake-Shoe & Fdy. Co.
C. A. COFFIN, President General Electric Co.
F. H. EATON, President American Car & Foundry Co.
H. ELLIOTT, JR., Vice-President Elliott Frog & Switch Co.
WILLIAM GOLDIE, SR., William Goldie, Jr., & Co.
N. HOFSTOT, President Pressed Steel Car Co.
H. S. HAWLEY, President Railroad Supply Co.
A. B. JENKINS, Jenkins Bros.
ALBA B. JOHNSON, Baldwin Locomotive Works.
B. F. JONES, Jones & Laughlin Steel Co.
A. M. KITREDGE, Vice-President Barney & Smith Car Co.
W. V. KELLEY, President Simplex Railway Appliance Co.
GEO. J. KOBUSCH, President St. Louis Car Co.
E. B. LEIGH, Vice-President Chicago Railway Equipment Co.
WM. LODGE, President Lodge & Shipley Machine Tool Co.
CHARLES MILLER, President Galena-Signal Oil Co.
CHARLES A. MOORE, Manning, Maxwell & Moore.
FRANKLIN MURPHY, President Murphy Varnish Co.
D. C. NOBLE, President Pittsburg Spring & Steel Co.
H. KIRKE PORTER, H. K. Porter Co.
A. J. PITKIN, President American Locomotive Co.
ALFRED A. POPE, President National Malleable Castings Co.
H. S. PAUL, President Verona Tool Works.
GEORGE A. POST, President Standard Coupler Co.
C. W. SHERBURNE, President Star Brass Mfg. Co.
C. A. STARBUCK, President New York Air Brake Co.
W. W. SALMON, President General Railway Signal Co.
H. A. SHERWIN, President Sherwin-Williams Co.
ALBERT WAYCOTT, Vice-President Damascus Brake Beam Co.
H. H. WESTINGHOUSE, Vice-President Westinghouse Air Brake Co.
W. W. WILLITS, Vice-President Adams & Westlake Co.
J. ALEXANDER BROWN, Secretary.

GENERAL COMMITTEE OF ARRANGEMENTS.

Hayes Lifting Derail.

This device, made by the Hayes Track Appliance Company, Geneva, N. Y., which was put on the market only about a year ago, is now in use on 80 railroads, and the makers show favorable testimonials from all quarters, including many from officers of roads where snow is troublesome and where the

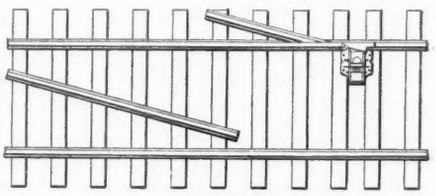


Fig. 1—Derail with Deflecting Guard Rails.

advantages of this derail in the matter of keeping it free from snow are therefore thoroughly appreciated.

In applying this derail at the ends of side tracks it has been found in many places that it can safely be placed close enough to the clearance point to increase the capacity of

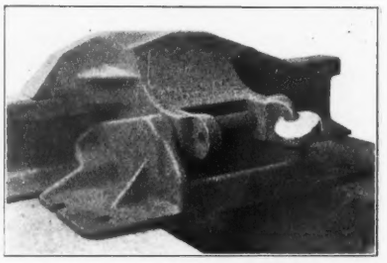


Fig. 2—Hayes Pivot Derail, Rear View.

the track, if there are connections at both ends, fully one car, as compared with the ordinary arrangement of split-switch derails. Where the Hayes derail is thus placed, deflecting guard rails may be applied, as shown in Fig. 1, to make sure that a derailed car or engine will be kept clear of the main line.

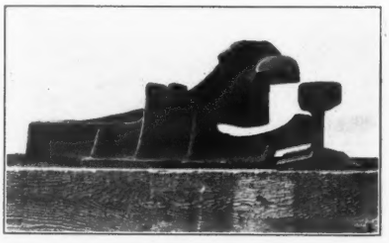


Fig. 3—Hayes Lifting Derail.

By the use of a short piece outside of the running rail, to guide the right hand wheel, supplemented by another piece between the running rails, to guide the left hand wheel, it is made unnecessary to use long ties or to widen the roadbed.

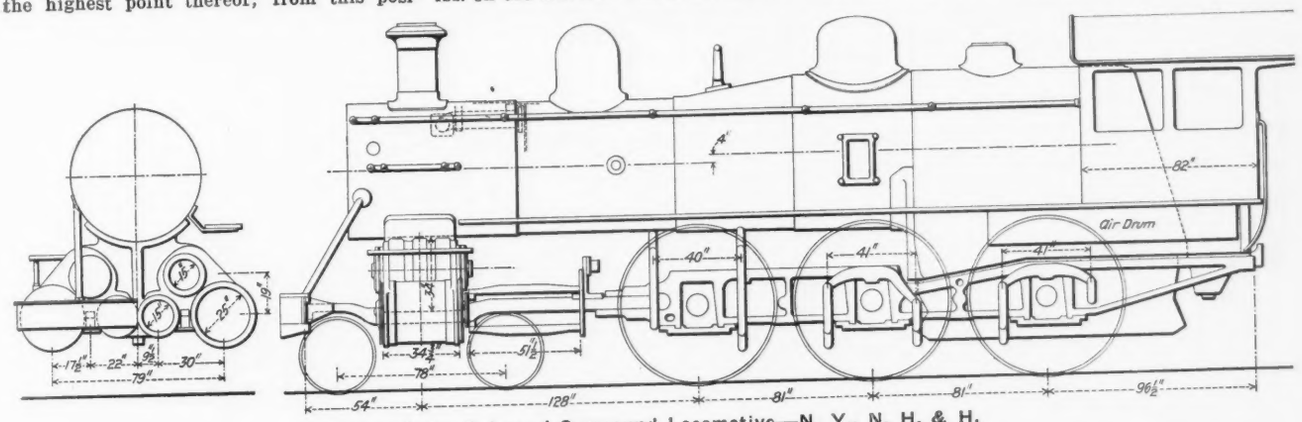
The Hayes Track Appliance Company also makes a pivot derail, a rear view of which is shown in Fig. 2. The view is taken from

the heel side, showing the hand-hold flange for throwing it over, and showing also the shape which is given to the block to carry wheels over in the reverse direction. The office of the right-hand lug, to provide a place for a padlock, is obvious. The left-hand lug is for a connecting rod to a target, when a target is used. The pivot derail has an advantage in ease of movement where it is to be thrown by hand. The Erie Railroad has applied derails of this pattern at all of the tracks leading to two of its important turntables at Jersey City.

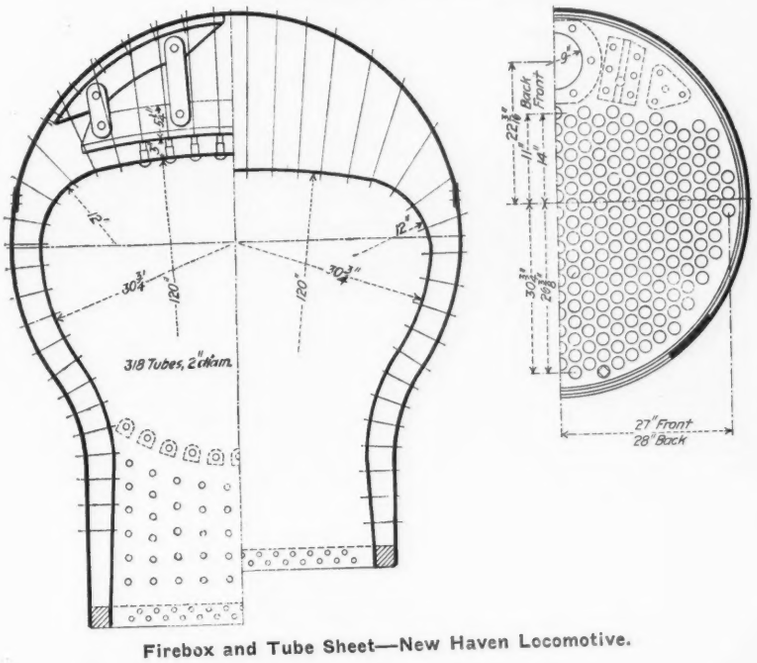
The standard form of the lifting derail is shown in Fig. 3. In this illustration the block is in the center of its stroke and at the highest point thereof; from this position it falls either to the closed or the open position by gravity. This design was illustrated in the *Railroad Gazette* of March 11, 1904.

Four-Cylinder Balanced Compounds for the New Haven.

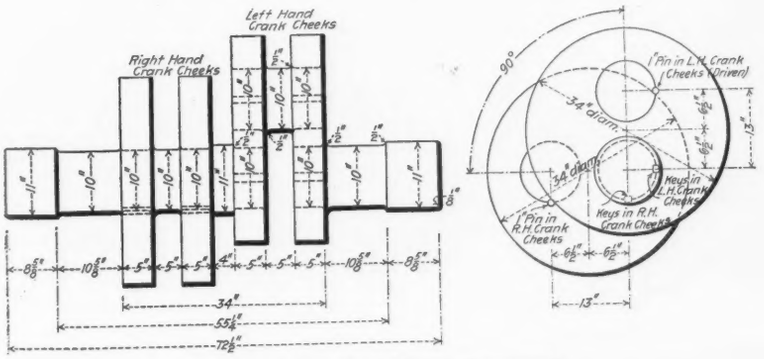
In our issue of Nov. 25, 1904, was a short description of one of the four-cylinder balanced compound locomotives built by the Baldwin Locomotive Works for the New York, New Haven & Hartford. The illustrations herewith show the general dimensions and some of the details of the locomotive. The engine weighs 160,600 lbs., with 123,100 lbs. on the drivers. The boiler has a narrow fire-box and a total heating surface of 2,666 sq. ft. The crank axle is of the built-up disk type. All cylinders drive the forward axle. The New Haven has ordered 22 engines of this type.



Four-Cylinder Balanced Compound Locomotive—N. Y., N. H. & H.



Firebox and Tube Sheet—New Haven Locomotive.



Crank Axle—New Haven Compound.

"Composite" Telephone Lines.

Composite lines—wires primarily designed for telegraph working but equipped with telephones for use, to a limited extent, simultaneously with the telegraph instruments—may now be found on many different railroads in this country; and so extensive a use of this inexpensive convenience warrants a word of notice. The American Telephone & Telegraph Company has furnished "composite" apparatus for 45 roads, as follows:

Atlantic Coast Line,
Baltimore & Ohio,
B. & O. Southwestern.
Bessemer & Lake Erie.
Boston & Maine,
Central Indiana,
Central Vermont,
Chicago, Burlington & Quincy,
Chicago & Eastern Illinois,
Chicago & North Western,
Cincinnati, Hamilton & Dayton,
Chicago, St. Paul, Minneapolis & Omaha,
Chicago Great Western,
Chicago & Grand Trunk,
Chicago, Milwaukee & St. Paul,
Chicago & Alton,
Chesapeake & Ohio,
Cleveland, Cincinnati, Chicago & St. Louis,
Colorado & Southern,
Delaware & Hudson,
Denver & Rio Grande,
Duluth & Northern Minnesota,
Duluth, Missabe & Northern,
Duluth & Iron Range,
Erie,
Escanaba & Lake Superior,
Elgin, Joliet & Eastern,
Great Northern,
Grand Rapids & Indiana
Illinois Central,
Kansas City Southern,
Lake Shore & Michigan Southern,
Lehigh Valley,
Long Island,
Michigan Central,
N. Y. Central & H. R.,
Northern Pacific,
Oregon Short Line,
Pere Marquette,
St. Louis & San Francisco,
San Pedro, Los Angeles & S. L.,
Southern,
Southern Pacific,
Union Pacific,
Wabash.

On many of the "composite" wires there are two or more intermediate offices equipped with telephones. There is often a tendency, because the equipment is adaptable, to load lines with eight or ten stations. This is entirely proper when the traffic per station is small, but the traffic growth is likely soon to render the service very unsatisfactory. When there is much traffic there is usually considerable delay in obtaining the circuit, and any two stations using the line will, of course, prevent all the others from using it.

Sometimes the "composite" is applied on several sections of line in immediate sequence, with a switch at the junction of two contiguous sections, so that different sections may be in simultaneous but independent use, or the sections may be connected through for service between a station in one section and a station in another. Various combinations have been effected in this way.

Portable telephone sets may be used in conjunction with any of these arrangements. The portable set is designed for emergency service at points along the road where there is no convenient telegraph or telephone office. Besides being a valuable adjunct the portable set is very useful in itself, for com-

munication is often possible over a deranged pole line when it is not possible to communicate by telegraph. In the case of a line break there may be no continuous metallic conductor, but the telephone system is still workable, because the excessive induction between parallel wires, worked as single circuits with earth-return, permits communication by induction; then the "cross-talk," so annoying under normal conditions, is extremely useful.

The number of these stationary and portable sets now in use is very large, and the total length of "composited" telegraph wires is about 20,000 miles. This means about 20,000 miles of railroad, for in practically all cases there is only one "composite" on any one line of poles. This has been a quiet but useful adaptation of means to ends, under circumstances where expenditure for a more elaborate installation would not have been warranted. The demand was for inexpensive facilities on lines—grounded telegraph lines—already owned or controlled by the railroads. These being used there is no expense except for station equipment.

The telegraph lines are not usually efficient telephone circuits, because of the use of the earth as a return conductor, the excessive induction between two or more parallel grounded lines, and the defective conductivity of old iron wires, especially the poor joints. Special means must be adopted for eliminating the noise and for making calling signals without interfering with the telegraph. But all these difficulties have been successfully met.

A calling-signal system which is not independent of the telegraph flutters the telegraph relays. This is a simple method but it is a serious annoyance and delay to telegraph traffic if the telephone is used frequently. Owing to the excessive cross-talk between parallel grounded lines, it is not possible to operate two parallel circuits independently, on the same pole line. Part of the efficiency of the receiver is sacrificed in eliminating the noise found on these lines when ordinary telephones are used, and so a special arrangement was devised. It is usually the case that the talking efficiency exceeds the signaling efficiency, as regards distance. Good talking has been obtained for more than 200 miles; but the distance to which good service can be obtained on a copper circuit of No. 9 B. & S. gage (208 lbs.) is about 200 miles when there are no intermediate telegraph instruments; the presence of each intermediate shortens the line a few miles if uniform service is to be obtained. On No. 8 B. W. G. iron (378 lbs.) the limit is about 100 miles, and on No. 9 B. W. G. iron (305 lbs.) about 80 miles, for wires of B. B. grade which have not depreciated.

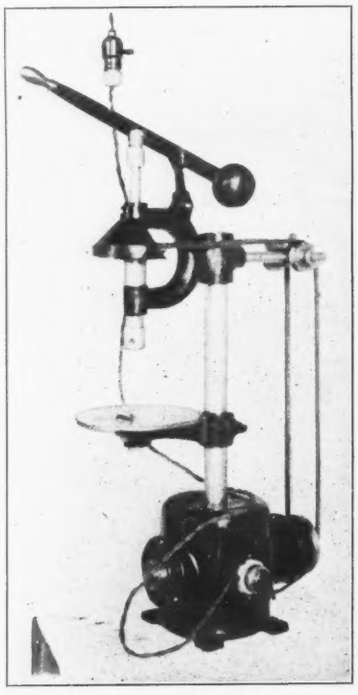
The existence of any considerable amount of cable is always a serious difficulty, especially rubber covered cables without a metal sheath, because of excessive induction and low telephonic efficiency. A metal sheath, connected to ground frequently, is of material assistance in reducing induction between earth-return circuits in cable.

If these difficulties and obstacles are intelligently dealt with, and energies are not wasted on attempts to telephone beyond reasonable distances, this means of communication will be found adaptable to a great variety of situations, and there is no reason why it should not be made to afford the surpassing benefits of telephone communication in innumerable cases where the expense of building a metallic-circuit independent telephone line would be entirely unwarranted.

Interesting facts concerning the use of "composite" circuits may be found in the report of a committee of the Railroad Telegraph Superintendents' Association published in the *Railroad Gazette* Sept. 9, last, page 331.

A Motor Driven Bench Drill.

The 10-in. sensitive bench drill shown in the accompanying illustration is made by Bartz, Wygant & Brown, Hornellsville, N. Y. It is designed for light, rapid drilling



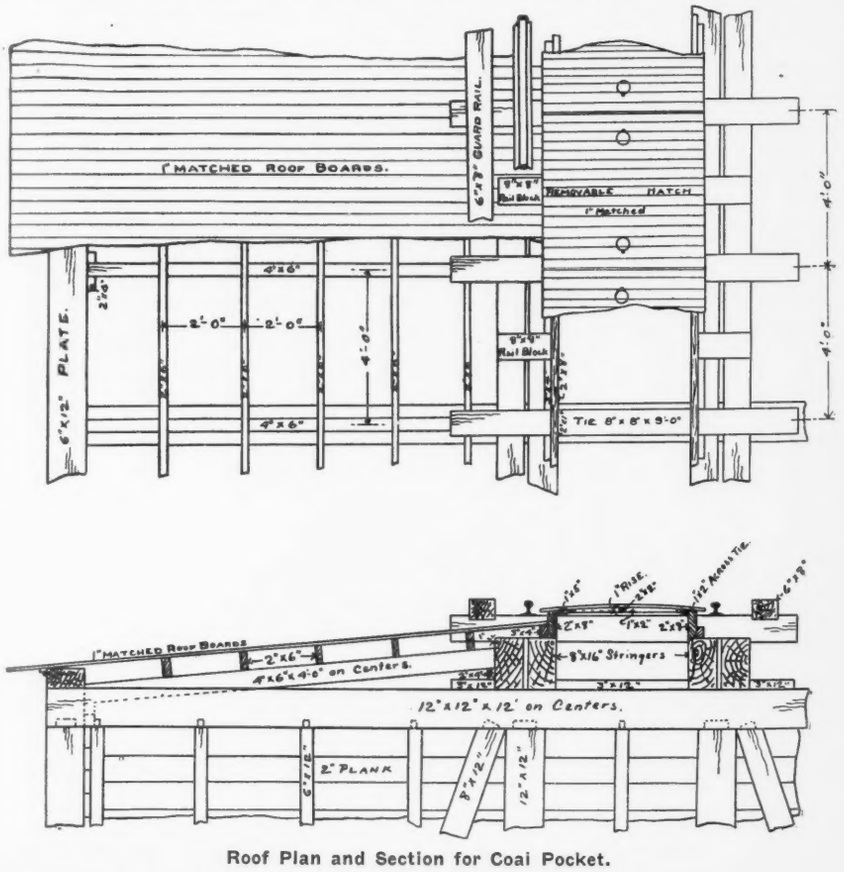
The Bartz, Wygant & Brown Motor Driven 10-in. Sensitive Bench Drill.

up to ¼ in. holes. It makes a very useful drill for bench and tool room use and for drilling oil holes, small tap holes, etc. The spindle is driven by a ⅜-in. round belt direct from the electric motor, which is located in the base of the drill. Five changes of speed are obtainable, as follows: 500, 750, 1,000, 1,350 and 2,000 r.p.m. The spindle is counterbalanced and is very sensitive. The table can be raised and lowered, swung to either side and locked in any position. A No. 000 Union drill chuck is fitted to the spindle. The greatest distance from the spindle to the table is 9 in., the vertical movement of the spindle is 2¼ in., and the verticle adjustment of the table is 6½ in. The diameter of the table is 8 in. and the distance from the center of the spindle to the frame is 5¼ in. The weight of the drill complete is 100 lbs. The motor is of the bi-polar type wound for 110 or 220 volt, direct current, and it can be connected to any electric light socket. The motor bearings are of the ring oiling type; they require very little attention, and do not heat and cause trouble. The motor is fully inclosed and is absolutely dust and dirt-proof.

Roof Plan for a Coal Pocket.

BY PAUL STERLING,
Asst. Engr. N. Y., N. H. & H.

The accompanying drawing shows an economical and desirable roof plan for a coal pocket with track on top, designed to be installed by a railroad for private enterprises. As 90 per cent. of the coal is carried in hopper bottom cars, a design which will at once facilitate the unloading of this class of cars and make a practically water-tight roof with economy in construction, is desirable. The drawing, which explains itself, fulfills these requirements, providing a continuous removable hatch, the same as on a boat, between the rails. The water drains off from the hatch on either side under the rails to the roof proper and thence over the eaves. The hatch is practically water-tight; wholly so if a water-tight covering is provided, and it has proved very satisfactory to its operator.



Roof Plan and Section for Coal Pocket.

GENERAL NEWS SECTION

NOTES.

In the County of Habersham, Ga., a superintendent of the Southern Railway has been fined $1,000 for running a freight train on Sunday, and the Supreme Court of Georgia has affirmed the judgment.

The Lackawanna special trains of United States Express Company cars run every day from New York to Chicago in 24 hours. The business of the company amounts to 20,000 packages every night from New York to western points over the Lackawanna. Eighty express wagons empty their freight through 20 doors of the large warehouse at Hoboken, and 50 porters sort the matter.

The report of the Interstate Commerce Commission on the illegal coal rates made by the Atchison, Topeka & Santa Fe, which was published in the *Railroad Gazette* of February 10, has been referred to the Department of Justice, and that department has engaged special counsel in the persons of Judson Harmon, of Cincinnati, former Attorney-General, and F. N. Judson, of St. Louis, to examine the matter with a view to beginning a criminal proceeding if they believe that the evidence warrants such action.

Press despatches of Monday last reported severe cold weather throughout the states between Chicago and the Rocky Mountains, the mercury going to 25 deg. below zero at Kansas City and to far below the freezing point in New Mexico and northern Texas. At Memphis it went to zero and at New Orleans to 25. The Secretary of the Oklahoma Live Stock Association estimates that 50,000 head of cattle were lost on the plains, the largest loss since 1896. At Sioux City, Iowa, and other places, the supply of coal was nearly exhausted on account of the blockade of the railroads by snow. Near Butler, Mo., and near Salina, Colo., passenger trains were blocked many hours and the passengers were rescued with difficulty.

The Great Northern steamship Minnesota, which sailed from Seattle Jan. 23 on her maiden voyage to the Orient, carried the most valuable cargo ever loaded at a Pacific coast port. It consisted of 26,000 tons of merchandise, valued at $1,804,633. The largest single shipment was one of 5,000,000 lbs. of cotton valued at half a million dollars, while the smallest was a pair of stockings, listed on the manifest as worth $1. Two consignments of cotton fabrics aggregate 6,684,317 yards, worth $392,656, while among other small consignments were a fountain pen, a razor strop, and a baseball outfit. There were 400 pieces, boxes, crates and packages of machinery, 146 lathes and boxes of lathes, 35 boxes of castings, 200 boiler tubes, and 74 kegs of bolts; 42,754 copper ingots, 896,117 lbs., worth $138,000.

"Freight Traffic Agency" is the name of a concern which has just been established in Pittsburg to handle freight rates, claims and tracers for shippers whose business is not sufficiently large to warrant the employment of a traffic agent. The Manager is Mr. Ira S. Bassett, a man of long experience in railroad work and formerly connected with the Pennsylvania Company. Associated with him is Mr. J. T. Crutchfield, for many years in the traffic department of the Louisville & Nashville. They offer their services both to consignors and consignees; they will quote rates, check freight bills, attend to claims for overcharges, and in all respects give to small shippers the advantages enjoyed by large concerns which have traffic men of their own. They will trace shipments "by wire, by letter, or in person."

Public Buildings Bill.

The Committee on Public Buildings and Grounds of the House of Representatives authorized a favorable report on Feb. 11 on the omnibus public buildings bill, which carries an appropriation of about $10,000,000.

Belgian Railroad Material for Argentina and England.

Large orders for railroad material and structural iron have been placed in Liège, Belgium, by firms in Argentina. They are divided among four of the principal mills of Liège, Belgium, and are being expedited as rapidly as possible. These, as well as other outside orders, have encouraged the manufacturers of steel and iron material to improve their works, and to replace old plants with modern, up-to-date machinery of extended capacity and capable of meeting demands for quick delivery. Two important steel works of Liège are at present working on an order of 6,800 tons of street rails for tram cars for English firms.—*U. S. Consular Report.*

Turkish Railroads.

The principal railroad lines in Turkey are owned and operated by foreign companies. According to latest statistics the Austrian companies there own 785 miles of railroad. The Smyrna-Aidin Railroad, 321 miles long, belongs to an English company. German companies own the Anatolian railroad lines of 644 miles, and the Saloniki-Monastir Railroad of 136 miles. The roads built by the French are the Smyrna-Cassaba line, 322 miles; the Syrian lines, 272 miles; the Junction-Salonica-Constantinople, 317 miles, and the line from Jaffa to Jerusalem, 54 miles. The Turkish Government guarantees a certain amount of income to the owners of these lines, and any deficiency of operating expenses is to be made up by the Government, under which arrangement the latter had to pay on the operations of the year 1903, to the French lines, $2,244,590, and to the German lines $1,246,780. The English companies earned enough to cover stipulations, and the Austrian lines worked so well that they had to pay $365,928 to the Turkish Government as its share of surplus earnings.

Awards to the General Electric Co.

The International Committee of the Louisiana Purchase Exposition has recognized the engineering ability of the designers of the apparatus exhibited by the General Electric Company in awarding grand prizes as follows: To Elihu Thomson, Swampscott, for various applications of electricity; also to C. P. Steinmetz, Schenectady, N. Y., for electric lighting, and to F. J. Sprague, New York City, for application of electricity to transportation.

Gold medals were awarded to C. G. Curtis, of New York City, "the originator of a successful American multi-stage steam turbine"; to W. L. R. Emmett, of Schenectady, N. Y., "designer of the vertical type of Curtis steam turbine and generator," and to W. B. Potter, Schenectady, N. Y., for applications of electricity to transportation.

Silver medals were awarded to W. S. Moody, Schenectady, N. Y., for transformers; to E. M. Hewlett, Schenectady, N. Y., for distribution of energy, switchboards, etc.; to H. F. T. Erben, Schenectady, N. Y., for apparatus for generating electricity; to H. G. Reist, Schenectady, N. Y., for apparatus for generating electricity; to L. T. Robinson, Schenectady, N. Y., for scientific apparatus, measuring apparatus and laboratory and standard instruments, and to F. P. Cox, Lynn, Mass., for measuring instruments, indicating, recording and integrating.

Ferry Boat Goshen.

The Erie Railroad has put in service between New York and Jersey City its new ferryboat Goshen, just received from the Harlan & Hollingsworth Co., Wilmington, Del. The Goshen is a sister boat, except in a few minor details, of the Tuxedo and Arlington; and a double-deck boat with twin-screws. She came from Wilmington under her own steam and made the run in about 10 hours. Her length is 224 ft.; beam, 64 ft.; draft, 13 ft.; tonnage, 1,474. There are two Scotch boilers, each 12 ft. 9 in. by 12 ft. 9 in., with steam pressure of 150 lbs.; double compound engine of 1,900 h.p., capable of producing a speed of 16 miles per hour. There are two 15 k.w. G. E. generators, supplying 350 lights, which will make the boat one of the most brilliantly illuminated on the North river. It is heated by the Sturtevant hot air system, heat conducted to all parts through fireproof ducts. The deck is steel, covered with creosoted blocks. The side houses are built of ⅜ in. steel, and ceilings covered with heavy galvanized iron, lined with asbestos. The cabins are furnished in old golden oak. The stairways and the floors of the upper saloon are covered with rubber tiling of fancy pattern. There are 1,000 block cork life preservers, and four life boats; seating capacity of the vessel, 900. It was built from designs of J. W. Millard, the railroad company's marine architect.

The McCullough, one of the old type single-deck ferryboats, will go out of commission and is to be entirely rebuilt from the steel hull, into a double-deck boat; and new engines will be put in. She already has twin screws.

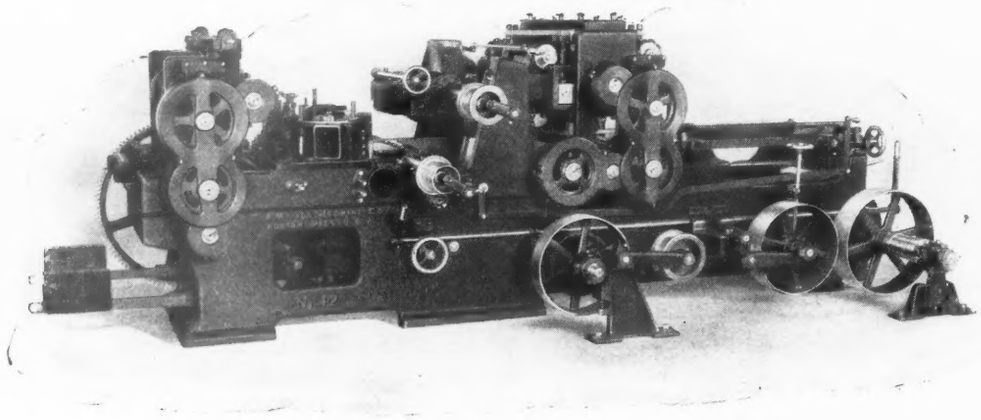
Steam Turbine Plant in Klondike.

The Westinghouse Companies have just received an order for the equipment of a power house for the electrical operation of gold-dredging boats on the Alaskan rivers. The plan is an entirely new one and involves many interesting features. The Canadian Klondike Mining Company, after a visit by its officers to the Westinghouse works at East Pittsburg, has decided to install a 400-kilowatt turbo-generator in the power house, to be driven by a 600 horse-power Westinghouse-Parsons steam turbine. The dredge boats are being built by the Marion Steam Shovel Company, of Marion, Ohio. On these boats will be installed induction motors, aggregating a total of about 500 horse-power, and varying in size from 7½ to 100 horse-power. The fact that this company is willing to install a plant of this nature so far from the manufactory and possible repairs, shows the confidence engineers place in this type of unit. The power house will be located at Dawson City, and the dredges will operate on the Yukon river and its tributaries. Lines for transmitting power will be strung from the station to the boats wherever they may be working. Electrical machinery is used very extensively in mining operations, but this

plant will be watched with interest, owing to the remoteness of the country and the new field which will be opened.

A New Planer and Matcher for Car Shops.

The accompanying illustration shows the No. 12 new fast feed planer and matcher made by the S. A. Woods Machine Company, Boston, Mass. This machine will work 18 in. or 30 in. wide by 8 in. thick. It is especially adapted to car shop requirements, but it is also useful for a wide range of other work. The machine is very heavy and rigid and is intended for dressing heavier stock than the ordinary planer and matcher can care for. It is fitted with a patent adjustable wedge platen, which provides for instantly changing the cut of the top and bottom heads, distributing it as desired, without altering the finished thickness of material or location of matching. A patent system of weighting by one pair of levers, obviating overhead weights, is also provided as well as split feed pulleys for quickly changing from one rate of feed to another, and patent knife setting gages. The top rolls and cutter head are adjustable by hand, and the hoisting screws operate on ball bearings, thus the changes in thickness may be quickly and easily made. There are six 9 in. feed rolls and the top feeding in rolls are instantaneously adjustable from the operator's position at the feeding-in end of the machine.



The S. A. Woods New Planer and Matcher for Car Shops.

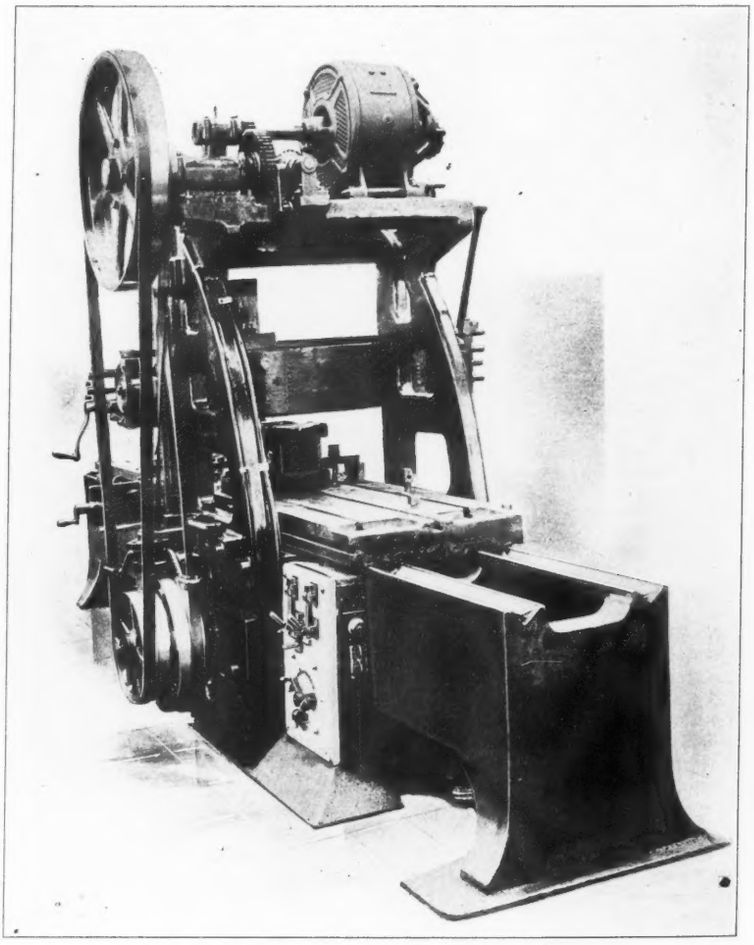
Motor-Starting Panels with Circuit-Breakers.

One of the recent changes in electrical practice is the general adoption of switchboard panels containing the control apparatus for individual motors. Before their introduction and in those installations where they are not yet used, controlling rheostats, line switches and protective devices have been mounted in the most convenient place available, often with apparent disregard of fire risk or the protection of the operator. The use of a panel insures the proper mounting of the apparatus and provides a neat and convenient arrangement, with means for mounting in any desired location. The Westinghouse Electric & Manufacturing Company make two styles of starting panels for direct current motors. Both of these panels are fitted with a two-pole Type D circuit-breaker instead of the customary switch with fuses. The circuit-breaker is especiallly adapted for this use, as one pole is connected in each leg of the circuit, the poles closing independently but tripping simultaneously. In closing the circuit, if there is an overload upon the line, the pole first closed opens immediately upon closing the second, thus instantly interrupting the circuit and preventing damage. It is provided with hinged, movable contacts of the brush type, and with carbon tips to which the current is shunted when the circuit is broken, preventing sparking at the contacts. The circuit is fully broken at the contacts before there is any movement of the carbon tips. There are no springs except the strong strip of spring steel which carries the carbons, the blow of the armature tending to open the breaker and not simply to release the moving parts. The device is reliable in its action, and is adjustable for different loads.

These panels with circuit-breakers are furnished in two styles; those with field rheostats for motors requiring shunt field regulation for varying speed, and those without field rheostats, for constant speed motors. Since the field and starting rheostats accompany the motors, the price of the panel includes only the mounting of the rheostats.

A starting rheostat with minimum voltage release is generally employed with Westinghouse motors. As soon as the supply circuit is interrupted the rheostat automatically opens the circuit making it impossible to damage the motor by restoring full line potential to the circuit when the motor is at rest.

The field rheostat ordinarily provided



A Planer in the Omaha Shops of the Union Pacific Railroad Equipped with a Westinghouse Motor Starting Panel.

with the Westinghouse motors will stand continuously the field current of the machine with which it is used, in any position of the handle, and no combustible material is used in its construction.

The slab is of slate, with a dull black marine finish, harmonizing with the black oxide finish of the apparatus. When ordered, brackets are supplied for wall mounting; or gas pipe frames of rigid construction (such as are used upon the Westinghouse Type 7 B panels), are provided for mounting upon the floor. Capacities range from ⅛ to 50 h.p., 110 volts, and from ⅛ to 100 h.p., 220 volts. The panels vary from 11 in. x 23 in. x 1 in. to 20 in. x 48 in. x 1¼ in., according to the space required for the apparatus. In capacities to 10 h.p., 110 volts and 13½ h.p., 220 volts, panels without field rheostats are made with front connections if desired.

These panels are especially adapted for separate machine tool drive, being so designed as to permit mounting directly on the frame of the machine tool driven by the motor, as shown in the accompanying illustration.

Manufacturing and Business.

The Buckeye Jack Manufacturing Co., Louisville, Ohio, has made a shipment of jacks to Shanghai, China.

The Cambria Steel Co., Johnstown, Pa., is planning to build additional car shops, to double its present capacity.

Mr. L. A. de Berard has been appointed traveling sales agent for the Union Switch & Signal Co., with headquarters at Swissvale, Pa.

The Houston, Tex., office of the Walter A. Zelnicker Supply Company, St. Louis, Mo., is now in charge of H. E. Miller, 603 Binz Building.

Templeton, Kenly & Co., Ltd., Chicago, announce the election of J. R. Caldwell, formerly of the American Cotton Oil Co., to be Vice-President.

The Meadville Vise Co., of Meadville, Pa., maker of Barrett horizontal cylinder boring machines and vises, has changed its name to the Barrett Machine Tool Co.

The Demopolis Foundry & Machine Co. has been incorporated in Alabama with $50,000 capital to operate a foundry and machine shop by A. R. Smith, L. W. Spalding and W. M. Spencer.

The Nash Engineering Co. has been incorporated in New York with a capital of $50,000 to make machinery, by L. H. Nash, of Brooklyn, and H. S. Morton and Q. L. Morton, of Hoboken, N. J.

The Independent Railroad Supply Co., Chicago, has received another order for several miles of Wolhaupter rail joints from the Southern Railway, this being the third order from the Southern this year.

The Hartwell Iron Works, of Houston, Tex., has recently built a machine shop and foundry and is putting up a blacksmith shop, boiler and tank shop; also a pattern storage, a warehouse, an office and a car house. E. Y. Hartwell is President.

The Consolidated Car-Heating Company, of New York, has been given a contract for electric heaters for 122 steel cars being built for the Long Island Railroad Company, also orders for its double drum hot water heating equipments for 110 cars for the following roads: San Pedro, Los Angeles & Salt Lake, 26; Southern Pacific, 76; and Oregon Railroad & Navigation Company, 8.

The American Equipment Company, 523 Chemical Building, St. Louis, Mo., has been organized by E. C. Finley, Z. W. Davis and and J. L. Wilbanks. The company will deal in railroad supplies, including track and car specialties. It will also represent manufacturers in the St. Louis and southwestern territory.

The Evens & Howard Fire Brick Co., St. Louis, Mo., maker of fire brick and sewer pipe for culvert purposes with a yearly output of nearly 100,000 tons, received the grand prize at the World's Fair for its display in the Manufacturers' Building and a gold medal for its exhibit in the Mines and Metallurgy Building.

E. L. Byron, who has been with the Vulcan Iron Works Co., Toledo, Ohio, for the past 20 years, has been made General Manager. This does not mean the retirement of President Alexander Backus from the management of the concern, the appointment being made to relieve him of much of the responsibility to which he has hitherto been subject.

The Inter-Urban Car & Gasoline Engine Co. has been organized by S. W. Pierce as a successor to the Prouty-Pierce Locomotive Manufacturing Co., of Kansas City. The firm will continue to make gasoline locomotives for street car service between cities, and proposes to consolidate its business with that of Hugh Mathews, of the Mathews-Davis Gas & Gasoline Engine Co., Mr. Mathews to become President of the new company as soon as the necessary capital can be secured. S. W. Pierce, Junction City, Kansas, may be addressed.

The Walter A. Zelnicker Supply Company, St. Louis, Mo., is occupying its new six-story building at the northeast corner of Fourth and Locust streets. Business is reported to be good notwithstanding the bad weather, which usually retards business in this line. This company handles railroad material and factory supplies, and makes the Zelnicker line of specialties for railroads. There is a rail and equipment department maintained separately from the rest. Rails are sold cut to length for various purposes. The Zelnicker Company maintains its rail yards at New Orleans, La., and Mobile, Ala. The company has a plant at Alta Sida, East St. Louis, Ill., where car building and repairing is done. A large demand for Zelnicker and shaved straight-grained air-seasoned second-growth handles is reported.

Iron and Steel.

According to reports from Chicago, the Illinois Steel Co. has orders for 400,000 tons of rails for this year's delivery.

The New York, New Haven & Hartford is reported to have ordered 20,000 tons of rails and the Boston & Maine a similar quantity.

The Rock Island, according to reports, has bought about 36,000 tons of 85-lb. rails to be used largely on the main line between Chicago and Rock Island.

The Grand Trunk order for rails from the Dominion Iron & Steel Co. is for 25,000 tons, and not for the entire product of the works for two years, as previously reported.

The Southern Development & Construction Co. is planning to put up an iron furnace at Lynchburg, Va., with 100 tons daily capacity; it will also build a 100-ton furnace in Greenbrier, W. Va.

According to reports from Baltimore, the Baltimore & Ohio Railroad has ordered 45,000 tons of rails for delivery during the year from the following companies: Pennsylvania Steel Co., 10,000 tons; United States Steel Corporation, 25,000 tons, and Cambria Steel Co., 10,000 tons. Of these rails 4,400 tons will weigh 100 lbs. to the yard and the balance 85 lbs.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Iowa Railway Club.

At the meeting of this club on February 13, a paper was presented on "Creeping Rails, the Cause and Remedy," by W. F. Gould, of the Rock Island.

Franklin Institute.

At the meeting of the Sections in Philadelphia on February 16, the programme included a paper on the "Determination of Sulphur in Iron Ores," by John Howard Graham, of Philadelphia.

Western Railway Club.

The February meeting of the Western Railway Club, to be held in the Auditorium Hotel on Tuesday evening, the 21st, at 7.30 o'clock, will be unique in character. It is to be a past-presidents' meeting, and it is expected that all living ex-presidents of the club, which was organized in 1884, will be in attendance. A special souvenir programme, with portraits of all of the presidents, is being prepared, and a buffet luncheon will be served. No regular papers will be presented.

Iron and Steel Institute Meetings.

The annual general meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers on May 11 and 12. The annual dinner will be held—under the presidency of Mr. R. A. Hadfield—in the grand hall of the Hotel Cecil May 12. Awards for Carnegie research scholarships will be announced at the meeting. The autumn meeting will be held in Sheffield September 25-29. The Reception Committee in Sheffield includes the Lord Mayor as chairman, and the Master Cutler as vice-chairman. The Chairman of the Executive Committee is Colonel H. Hughes, C. M. G.

Members are invited to participate in an International Congress of Mining, Metallurgy, Mechanics and Applied Geology, to be held at Liége, Belgium, on June 26 to July 1, in connection with the International Exhition. The subscription to the Congress is 25 francs, and members should enter their names in that section of which they wish to receive the publications. The General Secretary of the Organizing Committee is Mr. Henri Dechamps, 16, Quai de l'Université, Liége. The subjects to be dealt with in the Metallurgical Section, comprise coke manufacture; blast furnace practice; influence of titanium, arsenic and other substances on iron and steel; removal of dust from blast furnace gas; slag cement; use of poor gas as motive power in rolling mills; new methods of open-hearth steel manufacture; alloys of steel with chromium, nickel, manganese, vanadium and tungsten; the forging press and steam hammer; electrometallurgy and the practical applications of metallography. Further particulars may be obtained from the secretary of the Iron and Steel Institute, London, Mr. B. H. Brough.

PERSONAL.

—Mr. Henry M. Sperry, the New York representative of the Union Switch & Signal Company, has resigned, and Mr. S. G. Johnson, for several years Signal Engineer in

the New York office, has been appointed in his place, with the title of Eastern Manager.

—Mr. Fred Mertsheimer, who has gone from Denver to Lima, Ohio, to become head of the mechanical department of the Cincinnati, Hamilton & Dayton, with the title of Superintendent of Motive Power, has been in railroad service since 1869. His first work was on the Union Pacific, where he was Assistant Foreman of Shops and Gen-

eral Foreman. From there he went to the Colorado Central as Master Mechanic. For six years from 1880 he was Superintendent of Motive Power for the Texas Pacific. After this he returned to the Union Pacific as Master Mechanic of the Kansas Division at Armstrong, Kan. He served that company as Superintendent of the Wyoming Division; Assistant Superintendent of Machinery, and Master Mechanic until 1897, when he went to the Kansas City, Pittsburg & Gulf as Superintendent of Machinery. He was General Superintendent of that company from 1897 to 1899. In 1902 he was Superintendent of Machinery for the Denver & Rio Grande, and now succeeds Mr. Cory as Superintendent of Motive Power of the Cincinnati, Hamilton & Dayton

—Mr. J. E. Gorman, Freight Traffic Manager of the Atchison, Topeka Santa Fe, was born in Chicago in 1863, and his whole railroad experience has been in that city. He

entered railroad service in 1877 as a car number taker for the Burlington, and remained with that company four years. For the next three years he held various clerical positions on the Chicago, Rock Island & Pacific. He was for a time on the Chicago & North Western, the Illinois Central, the Atchison, and in the service of Joy Morton & Company. He afterward returned to the Atchison, and was Assistant General Freight Agent. He was soon made General Freight Agent, then Assistant Freight Traffic Manager; and now he is put at the head of the freight department.

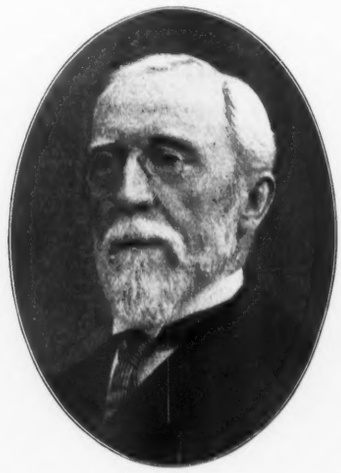
—Mr. William Lee Park, who was recently appointed General Superintendent of the Union Pacific, was born in Ovid, Mich., in 1859, but has been a resident of Omaha for many years. He was educated at the Segraves Academy of Omaha and the Baylies Commercial College at Keokuk, Iowa. Mr. Park began his railroad career in 1875 as

freight brakeman on the Union Pacific. From that position he rose steadily, serving as freight and passenger conductor, Assistant Superintendent and Superintendent of the Western District of the Nebraska Division. His last change was to the position of Superintendent of the Wyoming Division, which position he held at the time of his promotion to the General Superintendency, to succeed Mr. Gruber.

—Mr. Charles Frederick Daly, who has been promoted to be Passenger Traffic Man-

ager of the Lake Shore & Michigan Southern, the Michigan Central and the Lake Erie & Western, has for some time past been Chief Assistant General Passenger Agent of the Lake Shore & Michigan Southern at Chicago. Mr. Daly is 40 years old, and is a native of Canton, Ill. He has been in railroad service since 1878, having begun as a clerk on the Chicago, Burlington & Quincy. He served that company in various capacities until 1888, when he was appointed chief clerk to the General Passenger Agent of the Lake Erie & Western. The next year he was promoted to be General Passenger Agent of that road. Mr. Daly went to the Lake Shore in March, 1902.

—Mr. William K. Ackerman, formerly and for a number of years President of the Illinois Central, died recently at his home in Chicago, at the age of 73. Mr. Ackerman



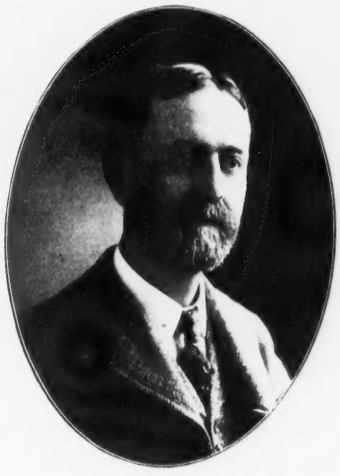
was born in New York city in 1832. His grandfather fought in the Revolution and his father in the war of 1812. Mr. Ackerman entered the employ of the Illinois Central in 1852 and for eight years was Assistant Secretary and Secretary in New York. In 1860 he was appointed Local Treasurer and went to Chicago. He held that position until 1871, when he became Treasurer. In 1875 he was appointed Auditor, and in 1876 Vice-President. The following year he was chosen to be President to succeed John M. Douglas and was President until 1883, and then Vice-President until his retirement from the company in 1884. Mr. Ackerman was at one time a writer on railroad and historical subjects, and wrote a work on "Early Illinois Railroads." He leaves a widow and two daughters.

—Mr. Edgar E. Calvin, who has been appointed General Manager of the Southern Pacific, with headquarters at San Francisco, has for the past year been General Man-

ager of the Southern Pacific Lines in Oregon, and of the Oregan Railroad & Navigation Company; and for seven years before that was on the Oregon Short Line. Mr. Calvin is about 47 years old and was born in Indianapolis, Ind. His first railroad work was

on the Indianapolis, Cincinnati & La Fayette as a telegraph operator. In 1877 he took a position on the Union Pacific as operator, and was subsequently station agent, train despatcher and trainmaster. In 1887 he was appointed Division Superintendent on the Missouri Pacific, but in 1891 returned to the Union Pacific. In 1895 he went to the International & Great Northern, where he was General Superintendent. This position he held until March, 1897, when he resigned and went to the Oregon Short Line as General Superintendent; and in the early part of 1903 he was promoted to be Assistant General Manager. From this position he went, the next year, to the Southern Pacific Lines in Oregon as General Manager, and is now promoted to the position of General Manager of the Southern Pacific.

—Mr. B. A. Worthington, hitherto Assistant Director of Maintenance and Operation of the Harriman Lines, on Friday of last



week became General Manager of the Oregon Railroad & Navigation Company and Southern Pacific lines in Oregon, succeeding Mr. E. E. Calvin. Mr. Worthington is 44 years old and began railroading at the bottom of the ladder as a messenger for the Central Pacific in 1874. In 1881 he entered the mechanical department at Sacramento as Chief Clerk to the General Master Mechanic, remaining for six years, when he was appointed Secretary to the Vice-President and General Manager. In 1895, he became Secretary to H. E. Huntington, Assistant to the President of the Southern Pacific, who was virtually executive head of the road. In 1899 Mr. Worthington formulated and put in operation the efficient tonnage rating system that has produced such good results on the Southern Pacific. From 1901 to 1903 he was Superintendent, first of the Tucson and then of the Coast Division; and at the end of that time was made Assistant to the General Manager. In April, 1904, he went to Chicago as assistant to Mr. Kruttschnitt; and it is this position that he now leaves to take charge of the Northwestern Grand Division of the Harriman Lines.

—Captain George J. Grammer, the new Vice-President and Traffic Manager of the Vanderbilt Lines west of Buffalo, was born in Zanesville, Ohio, 60 years ago. Capt. Grammer is one of the best known traffic men in the West, having begun his service in the world of transportation at the age of 13 as cabin boy for the Ohio River Steamboat Company. In the service of the old Evansville, Paducah and Cairo Line he rose steadily until he became Captain, and later was made Superintendent. His first railroad work was on the Evansville & Terre Haute in 1881, where for two years he was General Freight and Passenger Agent. He was promoted to the position of Traffic Manager of that road, and the Evansville & Indianapolis, and later was made General Traffic Manager. For about two years from 1890 he was General Traffic Manager of the Chicago & Eastern Illinois. He was at one time President of the Evansville & Terre Haute, the Evansville & Indianapolis and the

Evansville & Richmond. In 1894 he became head of the operating department of the Chesapeake & Ohio Southwestern as General Manager, but in the same year resigned to go to the Lake Shore & Michigan Southern as General Freight Agent. He was shortly promoted to be General Traffic Manager, and the first of this month was made Vice-President and Traffic Manager of the Cleveland, Cincinnati, Chicago & St. Louis, the Lake Shore & Michigan Southern, the Michigan Central and the Lake Erie & Western.

—Mr. Walter George Brownlee, who succeeds Mr. Jones as Superintendent of the Middle Division of the Grand Trunk at Toronto, Ont., has been in railroad service for the past 28 years. Mr. Brownlee was born at Lawrenceville, Ill., in 1858, and was educated at McKendree College, Lebanon, Ill. His first railroad service was on the Ohio & Mississippi, where he was telegraph operator. In 1878

he resigned and went to the Denver & Rio Grande, and for five years was operator, despatcher and trainmaster. He next went to the Union Pacific as train despatcher, but shortly left that company to go to St. Louis as Division Superintendent on the Missouri Pacific. Mr. Brownlee has been with the Grand Trunk since 1900. His first service was as Assistant Superintendent of the Eastern Division at Belleville. Later he was promoted to be Superintendent of the Western Division, and now is transferred to the Superintendency of the Middle Division.

—Mr. Nathan Guilford, who has been appointed Vice-President of the New York Central & Hudson River, in charge of traffic, was born in Cincinnati, Ohio, 64 years ago. Mr. Guilford has been in active railroad work for 46 years, having begun as a clerk in the freight department of the Little Miami. He was then for a time Agent of the People's Despatch and for a year (1869) was Secretary to the President of the Little Miami (Pennsylvania Company). In 1870 he was appointed Assistant General Freight Agent of the Baltimore & Ohio, and in 1872 General Freight Agent, which position he held for five years. For a few months in 1878, Mr. Guilford was Commissioner of the Western Executive Committee, and then for two years (1879-80) was Vice-President of the New

York and the Manhattan Elevated roads. In 1882 he was Assistant Commissioner of the Trunk Line Commission, and in a few years was promoted to be Commissioner of the freight department. In 1887 he was called to the New York Central as Traffic Manager.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—H. H. Rogers and H. C. Frick have been elected Directors, succeeding E. D. Kenna and John G. McCullough. J. L. Barnes, Superintendent, has resigned.

Buffalo, Rochester & Pittsburgh.—A. J. Johnson has been appointed Superintendent of the Middle and Pittsburg Divisions, with headquarters at DuBois, Pa. John McGarvey has been appointed Superintendent of the Rochester and Buffalo Divisions, with headquarters at Rochester, N. Y., effective Feb. 15.

Chicago, Cincinnati & Louisville.—C. L. Nichols, Superintendent, has resigned.

Cincinnati, Hamilton & Dayton.—A. C. Hinckley has been appointed Master Mechanic, with headquarters at Lima, Ohio, succeeding J. E. Gould, resigned.

Colorado & Southern.—B. F. Yoakum and H. E. Huntington have been elected Directors, succeeding E. J. Berwind and J. P. Cotton.

Denver & Rio Grande.—A. C. Hinckley, Master Mechanic, has resigned. See Cincinnati, Hamilton & Dayton.

Erie.—The headquarters of E. P. Griffith, Superintendent of Telegraph, have been removed from New York City to Jersey City, N. J.

Georgia, Florida & Alabama.—F. R. Cooper

has been appointed Master Mechanic, with headquarters at Bainbridge, Ga.

Gulf & Ship Island.—F. B. McCutcheon has been appointed Chief Engineer, with headquarters at Gulfport, Miss., succeeding W. W. Vail, resigned.

Illinois Central.—J. F. Porterfield has been appointed Superintendent of the New Orleans Division of the Yazoo & Mississippi Valley, with headquarters at Vicksburg, Miss., succeeding J. J. Flynn, who has been appointed Superintendent of the Memphis Division of the Y. & M. V., with headquarters at Memphis, Tenn., succeeding E. T. Horn, resigned.

Indiana Harbor.—F. W. Fairbairn has been appointed General Freight Agent, with headquarters at Chicago, Ill.

Lake Erie & Western.—See Lake Shore & Michigan Southern.

Lake Shore & Michigan Southern.—Charles F. Daly, hitherto Chief Assistant General Passenger Agent, has been appointed Passenger Traffic Manager of this company, the Michigan Central and the Lake Erie & Western, with headquarters at Chicago. G. B. Wheeler, hitherto Division Freight Agent at Cleveland, has been appointed General Freight Agent of the L. S. & M. S., with headquarters in Cleveland.

Michigan Central.—See Lake Shore & Michigan Southern.

Minneapolis, St. Paul & Sault Ste. Marie.—H. C. Bayless, hitherto Chief Draughsman, has been appointed Mechanical Engineer.

New York, New Haven & Hartford.—R. H. Rogers has been appointed Master Mechanic at South Boston, Mass., succeeding C. J. Howe, resigned.

Oregon Short Line.—See Southern Pacific.

Oregon Railroad & Navigation Company.—B. A. Worthington, hitherto Assistant Director of Maintenance and Operation of the Harriman Lines, has been appointed General Manager of the O. R. R. & N., and the Southern Pacific Lines in Oregon, succeeding E. E. Calvin. See Southern Pacific.

Panama.—J. R. Shaler, General Superintendent, has resigned.

Pennsylvania.—Robert H. Large has been appointed Coal Freight Agent, a newly created position.

Southern Pacific.—E. E. Calvin, Vice-President and General Manager of the Oregon Railroad & Navigation Company, has been appointed General Manager of the S. P., with headquarters at San Francisco, succeeding W. H. Bancroft, who has been acting in that capacity. Mr. Bancroft will devote his time to the Oregon Short Line. See Oregon Railroad & Navigation Company.

Union Pacific.—Ernest Stenger has been appointed Assistant Superintendent of the Wyoming Division, with headquarters at Cheyenne, Wyo.

Yazoo & Mississippi Valley.—See Illinois Central.

LOCOMOTIVE BUILDING.

The Philadelphia & Reading is reported to have ordered 40 locomotives from the Baldwin Works.

The Kansas City, Mexico & Orient is reported to have placed a $1,000,000 locomotive order with the American Locomotive Co.

The Compania del Ferrocarril Central de Potosi, of Aguascalientes, Mex., has ordered one locomotive from the Porter Locomotive Co.

The Jamestown, Chautauqua & Lake Erie is reported to have ordered a gasoline locomotive from the Brooks Works of the American Locomotive Co.

The Pennsylvania System will, it is reported, order from outside builders for experimental purposes, two Cole balanced compound locomotives, two prairie type (2-6-2) locomotives, two consolidation (2-8-0) locomotives and two Vauclain compound locomotives.

The Holly River & Addison has ordered one 10-wheel (4-6-0) locomotive with cylinders 13 in. x 18 in. from the Lima Locomotive & Machine Works. The special equipment includes: Eames vacuum brakes on both engine and tender, Sellers' injectors, Ashcroft steam gages, Detroit sight-feed lubricators and Hayden pop valves.

The Atchison, Topeka & Santa Fe, as reported in our issue of February 3, has ordered 30 tandem compound, Santa Fe type, (2-10-2) locomotives, 30 compound Pacific type (4-6-2) locomotives and 15 compound Atlantic type, (4-4-2) locomotives from the Baldwin Locomotive Works. The Santa Fe and Atlantic type locomotives will be almost exact duplicates of the same types now in service. The details of the Pacific type have not yet been decided upon.

The Lima Locomotive & Machine Company are building a double-end (2-6-2) locomotive, with cylinders 15 x 20 in. and separate tender, for the Crowl & Spencer Lumber Co., of Longleaf, La. This locomotive will be equipped with Lima Locomotive & Machine Co.'s steam brakes. The company also has orders for a four-driver saddle tank locomotive with cylinders 12 in. x 16 in. for the Puget Sound navy yard at Bremer, Wash., and a small mine locotive for the Margaret Mining Co., of Welsh, W. Va.

The Erie, as reported in our issue of February 10, has ordered 50 simple consolidation (2-8-0) locomotives from the Rogers Works of the American Locomotive Co. for April and May delivery. These locomotives are to weigh 200,000 lbs., with 180,000 lbs. on drivers; cylinders, 22 in. x 32 in.; diameter of drivers, 62 in.; straight-top boilers, with a working steam pressure of 200 lbs.; heating surface, 3,361 sq. ft.; 380 lap-welded charcoal iron tubes, 2 in. in diameter and 16 ft. long; wide steel fire-box, 104 in. x 75 in.; grate area, 54.17 sq. ft.; tank capacity, 7,000 gallons and coal capacity, 14 tons. The special equipment includes: Automatic air-brakes, pneumatic bell ringer, sectional magnesia boiler lagging, inside-hung brake-beams, Erie Railroad standard headlights, metallic piston and valve rod packings, pneumatic sanding devices, bull's-eye nickel-plated sight feed lubricators, semi-elliptic and coiled driving springs, helical engine truck springs, helical and elliptical tender springs and cast-steel wheel centers.

The Southern has ordered 79 locomotives, instead of 75, as reported in our issue of February 3, including 50 simple consolidation (2-8-0) locomotives, 10 simple Pacific (4-6-2) locomotives and 10 simple switching (0-6-0) locomotives from the American Locomotive Co. and nine simple 10-wheel passenger (4-6-0) locomotives from the Baldwin Locomotive Works. The consolidation locomotives will weigh 200,000 lbs., with 180,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; radial stayed boiler, with a working steam pressure of 200 lbs.; heating surface, 3,517 sq. ft.; 437 wrought-iron tubes, 2 in. in diameter and 14 ft. 6 in. long; firebox, 108 in. long and 72½ in. wide; grate area, 53 sq. ft.; tank capacity, 6,000 gallons and coal capacity, 12 tons. The Pacific locomotives will weigh 219,000 lbs., with 135,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 72½ in.; radial stayed boiler, with a working steam pressure of 220 lbs.; heating surface, 4,065 sq. ft.; 322 wrought-iron tubes, 2¼ in. in diameter and 20 ft. long; firebox, 108 in. long and 72 in. wide; grate area, 54 sq. ft.; tank capacity, 6,000 gallons and coal capacity, 10 tons. The switching locomotives will weigh 145,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; radial stayed boiler, with a working steam pressure of 185 lbs.; heating surface, 2,486 sq. ft.; 300 iron tubes, 2 in. in diameter and 15 ft. 1½ in. long; iron firebox, 66 in. long and 66 in. wide; grate area, 29 sq. ft.; tank capacity, 4,000 gallons and coal capacity, eight tons. The 10-wheel locomotives will weigh 164,000 lbs., with 131,000 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 70 in.; radial stayed boiler, with a working steam pressure of 200 lbs.; heating surface, 2,300 sq. ft.; 288 iron tubes, 2 in. in diameter and 14 ft. 3½ in. long; firebox, 109 in. long and 42 in. wide; grate area, 31 sq. ft.; tank capacity, 5,000 gallons and coal capacity, 10 tons. The special equipment for all will include: Westinghouse-American air-brakes, Gollmar bell ringers, Magnesia boiler lagging, Waycott brake beams for consolidation and switching locomotives, Diamond special brake beams for Pacific and ten-wheel locomotives. Perfecto brake shoes, Schroeder headlights for consolidation and switching locomotives, Pyle-National headlights for Pacific and 10-wheel locomotives, Hancock injectors, Ajax journal bearings, U. S. metallic piston and valve rod packings, Coale safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs and Ashcroft steam gages.

CAR BUILDING.

The Pennsylvania has ordered 10 coaches from the Pullman Co.

The Coahuila & Zacatecas has ordered 15 gondolas from Barney & Smith.

The Illinois Central denies the report that it has ordered 1,000 box cars.

The American Car & Foundry Company reports miscellaneous orders for 98 cars.

The Chicago, Indianapolis & Louisville has ordered 500 box cars from Haskell & Barker.

The Detroit & Mackinac is reported to have ordered 14 cafe cars from Barney & Smith.

The Mobile & Ohio has ordered seven mail and baggage cars from the American Car & Foundry Co.

The Arms Palace Horse Car Company, of Chicago, has ordered four horse cars from Barney & Smith.

The Rodger Ballast Car Company has ordered 60 ballast cars from the American Car & Foundry Co.

The Norfolk & Western has ordered 10 first-class passenger coaches, five baggage and mail cars and five baggage and express cars from the American Car & Foundry Co.

The Ottawa River Railroad, it is reported, has awarded the contract for equipping the road to M. P. McGrath, of Easton, Pa., who was recently awarded the contract for building the road.

The Wisconsin Central has ordered 12 coaches, one chair car, one cafe and observation car and three baggage cars from the Pullman Co. All these cars will have Railway Steel-Spring Co.'s springs.

The Fort Wayne & Springfield (Electric), as reported in our issue of February 10, has ordered three compartment cars from the Niles Car & Manufacturing Co., of Niles, Ohio, for June 1 delivery. These cars are to weigh 60,000 lbs., measure 53 ft. long over all and 8 ft. 4 in. wide and have a capacity for 60 people. The special equipment includes: Smith improved heating system and Peckham trucks.

The Southern, as reported in our issue of February 3, has ordered two mail and baggage cars from the American Car & Foundry Co. These cars will be 75 ft. long and 9 ft. 8½ in. wide. The special equipment will include: Diamond special brake beams, Westinghouse air-brakes, Southern Ry. specification brasses, Janney-Buhoup couplers, Miner tandem draft rigging, Harrison dust guards, Pintsch light, Railway Steel Spring Co.'s springs, Buhoup short vestibules and Paige wheels.

The Seaboard Air Line has ordered 50 stock cars of 60,000 lbs. capacity, instead of 40 as reported in our issue of February 3, from the Western Steel Car & Foundry Co.

These cars will weigh 30,000 lbs., and measure 36 ft. long, 8 ft. 5 in. wide and 7 ft. 6 in. high, all inside measurements. The special equipment will include: Westinghouse air-brakes, Tower couplers, Jones doors, Dayton draft rigging, Symington journal boxes and Seaboard Air Line standard diamond arch-bar trucks.

The Atlantic Coast Line has ordered 14 coaches, three combination mail and baggage cars and one combination passenger and baggage car from the American Car & Foundry Co., all for March delivery. All cars will weigh about 85,000 lbs., and measure 61 ft. 2 in. long, 9 ft. 8 in. wide and 14 ft. 4 in. high. The special equipment for all will include: Diamond special brake beams, Westinghouse air-brakes and friction draft rigging, Janney-Buhoup couplers, Adams & Westlake door fastenings, Harrison dust guards, and Pintsch light; for coaches and combination passenger and baggage cars, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material and Pullman vestibules.

BRIDGE BUILDING.

ALBION, IND.—Bids are wanted March 7, by John L. Henry, Auditor, for building three steel and concrete bridges in Noble County. J. T. Johnston is Superintendent of Bridges.

BENTONVILLE, ARK.—Bids are wanted March 25 by Marion Douglas, County Clerk, for building two steel bridges, one over Sargon creek and the other over Osage river, in Benton County.

CARILLON, ONT.—A petition has been made to the Dominion Government by the Central Counties Railway Co. for permission to build a bridge from Point Fortune, on the south side of the Ottawa river, to Carillon, in the County of Argenteuir.

CARMEL, N. Y.—Bids are wanted by the Commissioner of Highways for putting up an iron and stone bridge 75 ft. long over the railroad tracks.

COLUMBUS, GA.—The Muscogee County Commissioners will build two steel bridges over Randall creek.

COLUMBUS, NEB.—Bids are wanted March 1, by John Graf, County Clerk, for building all the bridges that may be needed in Platt County for one year.

DOVER, ONT.—Bids are wanted February 23, by H. N. Bechard, Commissioner, at Dover, South, for building two steel bridges in the township of Dover, county of Kent.

HARRISBURG, PA.—Bids are wanted February 28 by the State Board of Public Grounds and Buildings, for building a steel bridge over Penn's creek, one mile north of Selinsgrove.

ILLINOIS.—On Jan. 31 the U. S. Senate passed the bill, previously passed by the House of Representatives, authorizing the Kensington & Eastern R. R. Co. to build a bridge over the Calumet river, in Cook County, Ill.

LOUISA, KY.—The bill authorizing the Louisa & Fort Gay Bridge Co. to build a bridge over the Tug and Louis forks of the Big Sandy river was passed by the House of Representatives on Feb. 2. (Feb. 3, p. 38.)

MINNEDOSA, MAN.—Bids are wanted February 28 by E. B. Fisher for rebuilding and extending the Main street iron bridge.

NASHVILLE, TENN.—Application will be made to the legislature for permission to issue $500,000 of bonds to buy land for the approaches of the new Cumberland river bridge.

PARKER, CAL.—The Atchison, Topeka & Santa Fe, it is reported, will build a new bridge over the Colorado river at this place.

PENNSYLVANIA.—Both Houses of Congress passed the bill authorizing the Leckrone & Little Whiteley R. R. Co. to build a bridge over the Monongahela River, in Pennsylvania.

SIOUX CITY, IOWA.—Plans are being made for building a steel viaduct 1,100 ft. long over the tracks at Wall street; work is to be begun this spring.

SEAFORTH, ONT.—The Tuckersmith Township Council will put up a steel bridge to replace the Campbell bridge.

SYRACUSE, N. Y.—The New York Central, local reports state, will spend $100,000 for new bridges at this place, including a bridge over the Central and Lackawanna tracks at Syracuse Junction and one over the Oswego canal between North Selina and Willow streets.

STEWARTVILLE, ONT.—The McNab township council has decided to build a steel bridge over the Medawaska river, to cost about $18,000.

TOPEKA, KAN.—An election was held February 13 to vote on issuing bonds for building a steel viaduct over the 18 tracks on Branner street, to cost about $45,000, of which the city of Topeka is apportioned one-third. J. F. McCabe is City Engineer.

VAN BUREN, ARK.—On Jan. 30 the U. S. Senate passed the bill, previously passed by the House of Representatives, authorizing a bridge over the Arkansas river, at Van Buren, Ark.

WARREN, MINN.—Bids will soon be asked by the Minneapolis, St. Paul & Saulte Ste. Marie for building a steel bridge about 350 ft. long over the Red river, 17 miles west of this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTIC COAST LINE.—This company's Jacksonville & Southwestern division is being extended from Newberry, Fla., to Perry, 70 miles, and it is reported that the road will be in operation to the Suwanee river, 23 miles, about June 1.

ATCHISON, TOPEKA & SANTA FE.—This company, it is reported, will build a new tunnel under the Raton mountain, replacing the one which was built when the road was opened in to New Mexico.

BEAVER VALLEY.—This company's line from Vanport, Pa., on the Pennsylvania, to Beaver, on the Pittsburg & Lake Erie, 3½ miles, is now completed. (See Construction Supplement.)

BRATTLEBORO & WHITEHALL.—An agreement has been reached between the stockholders of this narrow-gage road, which runs from Brattleboro, Vt., northwest to South Londonderry, 36 miles, and the Central Vermont, which controls the New London Northern, which holds a mortgage of $100,000 on the Brattleboro & Whitehall. Under the terms of the agreement, the mortgage is to be foreclosed by the Central Vermont, which will rebuild the B. & W. and change it to standard gage. In connection with the rebuilding of the road, the Central Vermont will probably build a line into a large timber district.

CANEY RIVER.—This company's line from Bald Mountain, Tenn., to Huntsdale, 18 miles, has been finished. (See Construction Supplement.)

CARDIFF & TENNESSEE RIVER.—It is reported that Bolt, Koon & Borches have the contract for building this road, which is to run from Cardiff, on the Cincinnati Southern, to Hood's Landing, on the Tennessee river, five miles.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—This company has requested the city council of Sioux City to pass an ordinance providing for the construction of a spur track along the surface of Third street from Wall street to Jones street, with spurs into intersecting cross streets. The ordinance will be amended so as to give all roads the right to use the spur by paying a fair rental, and so that the track cannot be used as a storage track. The granting of the use of Third street to this company does not conflict with the franchise of the Great Northern, as the latter company will construct west from Jones street and the former east from Jones street.

COLORADO, WYOMING & IDAHO.—This company, which was incorporated in Wyoming in November, is reported to have surveyed its line from Fort Collins, Colo., northwest to Laramie, Wyo., 50 miles. Construction work will probably begin early in the spring. (November 25, p. 168.)

DENVER & INDIANA HARBOR.—This company has filed a charter in Illinois and proposes to build from Denver northeast to the state line, 15 miles, and from that point to Indiana Harbor, on Lake Michigan. Bertrand E. Walker, Robert J. Crary, E. T. Glennen, Herbert D. Howe and C. W. Hotchkiss, of Chicago, are incorporators.

DENVER & RIO GRANDE.—An officer writes that the building of a standard-gage branch from Durango, Colo., south to Farmington, N. Mex., about 52 miles, has been authorized by the directors. Construction work on this extension was commenced on February 2d, and will be rapidly pushed to completion. It begins at Durango, Colorado, the chief town in what is known as the San Juan mining region of southwestern Colorado, and follows a southerly course for twenty miles through Las Animas canyon, thence southwesterly through the open valley of Las Animas, terminating at Farmington, New Mexico, at the junction of the San Juan and Las Animas rivers. Five bridges will have to be built in the canyon. The principal towns along the route from Durango to Farmington are Cedar Hill., Colo., and Aztec and Flora Vista, N. Mex., situated in the order named. Chief Engineer E. J. Yard estimates that the total cost of construction will approximate $1,000,000, and he expects that the line will be finished by next September. The region tributary to this extension has hitherto been of interest chiefly to archæologists and relic hunters on account of the numerous Aztec ruins scattered about the mesas and the homes of the pre-historic cliff dwellers which are perched high up along the sides of the overhanging and almost inaccessible canyon walls. The greater part of this region is underlaid with valuable coal deposits, in addition to which large areas of fine agricultural land will be made available by the completion of the new line.

FORT WAYNE, VAN WERT & LIMA TRACTION.—This company, which is incorporated in Indiana with an authorized capital stock of $2,000,000 and an authorized bond issue of $2,000,000, has its road in operation from Lima, Ohio, northwest to Van Wert, 30 miles. The line from Van Wert northwest to Fort Wayne, Ind., 35 miles, is graded, fenced and bridged. The entire road parallels a line of the Pennsylvania.

GEORGIA NORTHERN.—It is reported that this company has filed a petition to increase its capital stock to $500,000, the proceeds to be used to build an extension from a point between Moultrie, Ga., and Pavo southeast to Valdosta, 35 miles. J. N. Pidcock, Jr., is General Manager at Moultrie.

GRINNELL INTERURBAN (ELECTRIC).—An incorporator writes that this company, of which O. K. Cole, of Grinnell, Iowa, is President, is to run from Grinnell northwest to Belle Plaine, 30 miles.

GREAT NORTHERN.—This company has submitted the following ordinances to the city council of Sioux City. An ordinance providing for the erection and maintenance of an elevated railroad structure by the Great Northern Company along Third street, commencing at Howard street and ending at the combination bridge. An ordinance providing for the construction and operation of a surface spur track by the Great Northern along Third street, from Jones street west to Perry creek, with spurs into intersecting cross streets. An ordinance requiring the vacation of certain alleys and properties affected by the proposed improvements by the Great Northern. These ordinances were so worded that the Great Northern would be given exclusive rights for the use of Third street between the points above named. The members of the council objected to this and

the following amendments were agreed upon between the members of the council and the representatives of the Great Northern. Third street is to be thrown open to all railroads, whether through lines or not, by a provision that the Great Northern's elevated structure may be used by any railroad desiring entrance into Sioux City by the payment of a fair rental based upon the valuation of the property. All railroads in the city are to have the right to make proper connections with the elevated tracks, and the surface track shall not be used for through service. Work upon the improvements must begin within one year. The use of Third street tracks for storage shall be forbidden, all cars being removed from the street when not in actual service. The amended ordinances will, it is expected, be adopted at the next regular meeting of the council.

Joliet, Plainfield & Aurora.—This company's line from Joliet, Ill., via Plainfield to Aurora, 20 miles, is now in operation. H. A. Fisher is General Manager. (See Construction Supplement.)

Kettle Valley.—The Republic & Kettle River and the Kettle River Valley, together known as the Kettle Valley Lines, are, it is reported, interested in a survey for an extension south from Republic, Wash., across the southern part of the Colville reservation to Spokane. The present line runs from Republic north to Grand Forks, B. C., 42 miles.

Lac La Belle & Calumet.—Surveys are being made under the charter of this road for a line from Red Jacket, Mich., through Kearsarge, Wolverine, Allouez, Mohawk and Phoenix to Lac La Belle, 30 miles. Surveys for an extension from Lac La Belle to Keweenaw will probably be made later.

Lewiston & Southeastern (Electric).—Construction work on this road has been begun. It is to run from Lewiston, Idaho, through Westlake, Cottonwood and Denver to Grangeville, Idaho, with a branch from Westlake to Nez Perces City, a total of 110 miles. The road is being built largely for freight traffic.

London & St. Clair.—This company has applied to the Dominion Government for authority to build from a point on the line of the Ontario & Quebec, west of the city of London, to a point on the St. Clair river at Sarnia, or between Sarnia and Lake St. Clair.

Louisiana Railway & Navigation.—The contract for the grading of this company's line from Baton Rouge to New Orleans, 77 miles, is reported to have been let to J. M. White, of New Orleans. The contract for grading 30 miles between Baton Rouge and Shreveport has also been let to the same firm. Work, it is reported, will immediately be begun.

Manistee & Repton.—This company's Monroeville extension from Shiverville, Ala., to Monroeville, six miles, has been completed. W. H. Louisell, of Manistee, Ala., is President. (See Construction Supplement.)

Millen & Southwestern.—This company's line is now in operation from Millen, Ga., on the Central of Georgia, to Vidalia, 53 miles.

Nashville & Huntsville (Electric).—Application has been made in Tennessee for a charter for this road, which is to be part of a projected electric system from Memphis, Tenn., through Nashville, Tenn., Birmingham and Montgomery, Ala., to Pensacola, Fla. From Nashville to Huntsville, Tenn., the line will be 107 miles long, and from Huntsville to Pensacola, 315 miles long.

Norfolk & Western.—This company, it is reported, has made extensive purchases of land in South Norfolk, Va., which will be used for new yards.

Oklahoma & Texas Southern.—This road, which is projected to run from a point on the Red river in Montague County, Tex., near Spanish Fort, through Nocona, Montague and Bowie and eventually southwest to Houston, is reported to have much of its line between Nocona and Bowie, 20 miles, already graded. Among the directors are S. D. Chamberlain and E. E. Churchill, of Fort Worth, and J. F. Clark, of Montague, Tex. (See Construction Supplement.)

Oklahoma & Cherokee Central.—An officer of this company, which was incorporated in June in Oklahoma, is quoted as saying that construction work will begin on April 1 from Pryor Creek, Ind. T., northwest to Chelsea, 20 miles. (June 24, p. 15.)

Oregon Short Line.—An officer writes that this company, as reported in our issue of February 10, has let the contract to the Utah Construction Co. for the first 30 miles of a branch from Minidoka, Idaho, across the Snake river to Twin Falls City, 60 miles. The 30 miles under contract has been graded and track laying is now under way. The Minidoka branch traverses lands that will be put under irrigation this year by water supplied by the Twin Falls irrigation project and it will also reach lands which will be brought under cultivation by the Minidoka Project of the United States Government irrigation works.

The same officer states that an extension of the Malad branch of about 30 miles from its present terminus at Garland, Utah, to Malad City, Idaho, is contemplated and building will soon be begun.

Ottawa River & Northern.—This company has applied to the Dominion Government for authority to build from Grenville, in Argenteuil County, Ont., to Montebello, and thence along the Rouge and North Nation rivers to a connection with the projected Grand Trunk Pacific near the Lievre river.

San Marcos Valley Interurban (Electric).—This company plans to build a line from San Marcos, Tex., via Martindale, Fentress and Prairie Lee to Luling, 25 miles. George W. Megrew is engineer in charge.

Santa Fe, Raton & Eastern.—This company has filed incorporation papers in Colorado with a capital of $300,000 to build from Raton, N. Mex., east to the Clark ranch, 10 miles.

San Francisco & Napa.—This road, which is to run from San Francisco, Cal., via San Raphael to Napa, 50 miles, has been all graded, and 12 miles of track have been laid out of Napa.

Southern Pacific.—An officer writes that the company has authorized the building of a road from Hazen, on the main line of the Central Pacific, to a point near Churchill, on the Carson & Colorado. This connection will run into lands which will soon be brought into cultivation in the Carson basin in consequence of the completion of the irrigation works of the Reclamation Service of the United States Government and will make an outlet from the Tonopah mining district shorter than the present route via Reno over the Virginia & Truckee.

South & Western Railway.—Press reports state that a new charter has been secured in Virginia for this road under the name of the South & Western Railroad, under which the proposed extension from Clinchport to Toms Creek will be built.

Southern.—Press reports state that the branch from Danville, Ky., to Harrodsburg, 10 miles, will be opened for traffic on April 1. W. J. Oliver & Co. are the contractors. (July 1, p. 24.)

St. Joseph, Albany & Des Moines.—F. S. Mordaunt, president and chief promoter of this company, which is planning the construction of a line from St. Joseph, Mo., to Des Moines, Iowa, originally projected as an electric road, says that the contracts for the first 40 miles of the line from Des Moines through Winterset, will be let in May; and that all the right of way in Missouri has been secured, also some in Ringgold and Union counties, Iowa.

Virginia Roads (Electric).—It is reported that an electric road will be built from Big Stone Gap, Va., via Stone, Appalachia and Norton to Wise, 30 miles.

RAILROAD CORPORATION NEWS.

Altoona & Logan Valley (Electric).—Newburger Bros. & Henderson, Townsend, Whelen & Co., and Bioren & Co., of Philadelphia, are offering at 97½ and interest part of $1,000,000 first and consolidated mortgage 4½ per cent. bonds of 1933 of this company. Of the authorized issue of $4,000,000, $2,500,000 of these bonds are already issued. They are guaranteed by the American Railways Co., of Philadelphia.

Boston & Worcester (Electric).—E. H. Gay & Co., of New York, are offering at 102½ and interest a portion of $243,000 first-mortgage two-year 4½ per cent. gold bonds of this company. This is part of an authorized issue of $2,500,000, of which $1,610,000 is outstanding.

Colorado & Northwestern.—*The Commercial and Financial Chronicle* says that a 10-year contract has been made between this company and the Colorado Southern by which the latter road will lay a third rail on its track from Boulder to Denver, so as to make a 3 ft. gage, over which the Colorado & Northwestern is to run trains into the union station at Denver.

Great Northwest Transit Company of Canada.—The Hudson Bay & Northwest and the Manitoba & Keewatin are asking authority from the Dominion Government to consolidate under the name of the Great Northwest Transit Co. of Canada.

Indianapolis Northern Traction.—Ervin & Co. and Toland & Co., of Philadelphia, are offering at 96 and interest part of $4,500,000 first-mortgage 5 per cent. gold bonds of this company, guaranteed by the Union Traction Co. of Indiana. The authorized issue is $5,000,000.

Louisville & Nashville.—The report of this company for the six months ending December 31 shows a surplus of $2,354,587 compared with $1,918,622 for the corresponding period in 1903, and $1,102,094 for the first half of 1902. The dividends paid were $1,800,000 compared with $1,500,000 for the first half of 1903.

St. Louis & San Francisco.—This company is reported to have bought the Orange & Northwestern, which runs from Orange, Tex., to Buna, 30 miles, where it connects with the Kansas City Southern. The St. Louis & San Francisco will shortly extend the line from Buna to Shreveport, La., 150 miles. Extensions from Buna to New Orleans, 150 miles, and from Buna to Sabine Pass, 50 miles, are also projected.

An officer of the Illinois Central is quoted as saying that an agreement has been made by which the St. Louis & San Francisco will use the tracks of the Yazoo & Mississippi Valley from Baton Rouge to New Orleans. It is also reported that the St. Louis & San Francisco will use the Texas & Pacific tracks from Memphis to Baton Rouge Junction.

Schenectady Railway.—The New York Central & Hudson River and the Delaware & Hudson, as recently reported, have purchased from the General Electric Co. the entire $600,000 capital stock of this road.

Southern Indiana.—King, Hodenpyl & Co., of New York, and George A. Fernald & Co., of Boston, are offering at 95 and interest the remaining $2,800,000 of the authorized $6,000,000 first-mortgage 50-year 4 per cent. gold bonds of this company, which owns 162 miles of steam railroad, including a belt line and terminal property in Terre Haute.

Washington (D. C.) Terminal.—This company has filed a mortgage with the United States Trust Co., of New York, as trustee, securing $12,000,000 first-mortgage 3½ per cent. gold bonds of 1945, of which $10,000,000 will probably be issued at once. The bonds are to be guaranteed by the Philadelphia, Baltimore & Washington (Pennsylvania) and the Baltimore & Ohio, which companies own the entire $2,500,000 of capital stock.